This guidebook was written for students, researchers and development practitioners engaged in supporting family farmers in Myanmar and other areas of Southeast Asia. It provides detailed methodological guidance to carry out farming systems analyses.

The guidebook provides key concepts and tools for a better understanding of farmers' decisions and practices. The guidebook helps nurture a professional dialogue between farmers and rural development practitioners, to effectively support family farmers' productive activities and their future aspirations.

The guidebook was developed by GRET in partnership with Yezin Agricultural University. It is based on 18 months of experience conducting farming systems research in five States and Regions of Myanmar.

Photo: Celine Allaverdian

Livelihoods and Food Security Fund

LIFT

UKaid from the British people

European Union

Australian Aid

Swiss Agency for Development and Cooperation SDC

Denmark

USAID from the American people

Government of the Netherlands

Sweden

afd Agence Française de Développement

Grand Duchy of Luxembourg

Development Cooperation

New Zealand Aid Programme

Irish Aid Rialtas na hÉireann Government of Ireland

GRET Professionals for Fair Development

Yezin Agricultural University

FARMING SYSTEMS ANALYSIS

A guidebook for researchers and development practitioners in Myanmar

FARMING SYSTEMS ANALYSIS

A guidebook for researchers and development practitioners in Myanmar

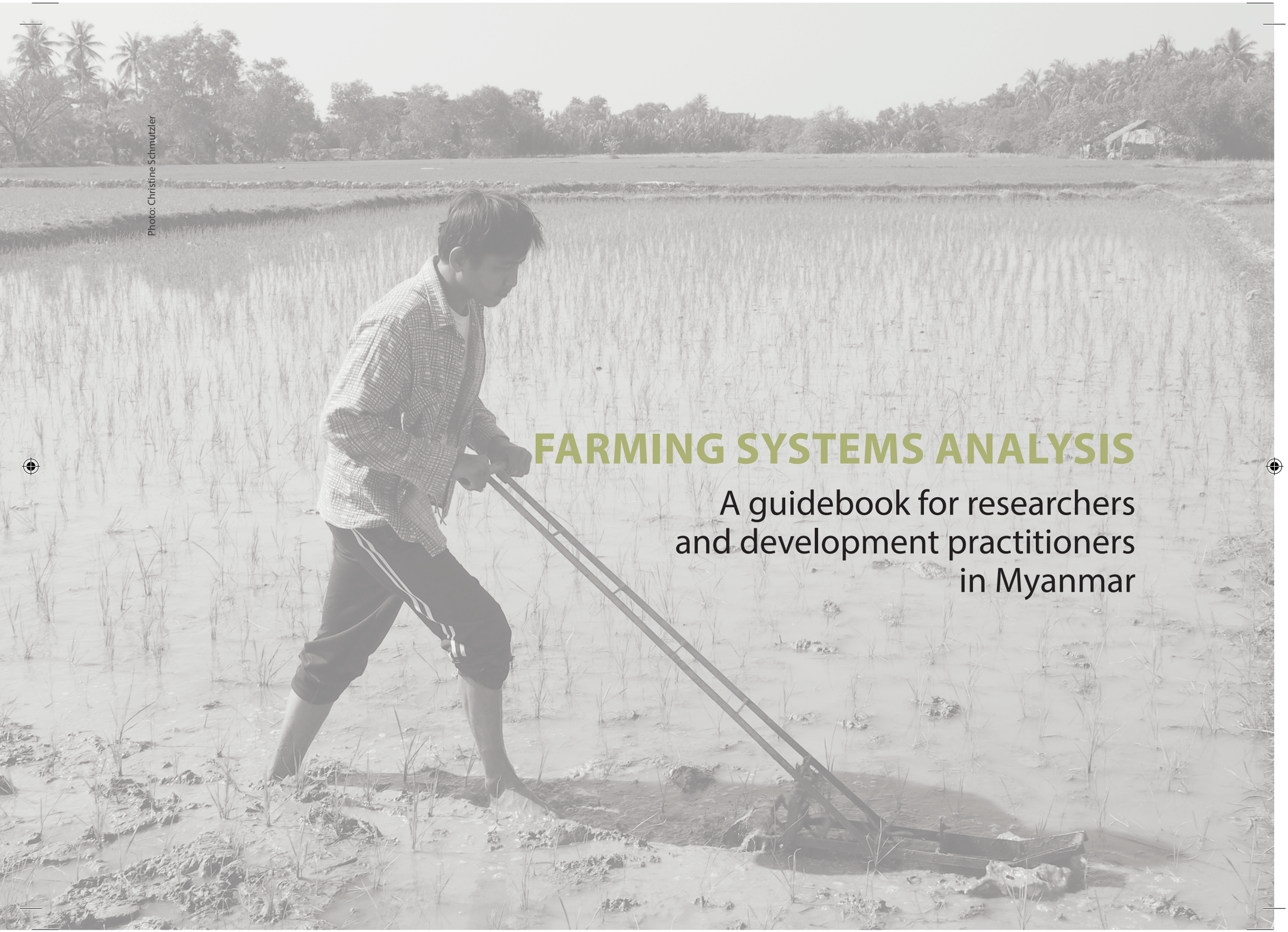


Photo: Christine Schmutzler

FARMING SYSTEMS ANALYSIS

A guidebook for researchers and development practitioners in Myanmar

Farming systems analysis: A guidebook for researchers and development practitioners in Myanmar

Published by: Gret-YAU, 2018

Written by: Jean-Christophe Diepart and Céline Allaverdian

Reviewed by: Dr Theingi Myint, Dr Nyein Nyein Htwe, Dr Kyaw Kyaw Win, Dr U Htet Kyu

With contributions from: Clarisse Frissard, Adriana Isabel Garcia, Yi-Jen Lu, Alyssa Pritts, Mya Darli Thant, Fue Yang

Suggested citation: Diepart, J.-C. and Allaverdian, C. (2018). *Farming Systems Analysis: A guidebook for researchers and development practitioners in Myanmar.* Yangon: GRET—Yezin Agricultural University

Graphic Design and Layout by: Christine Schmutzler

Printed in Myanmar

ACKNOWLEDGEMENTS TO LIFT DONORS
We thank the European Union and governments of Australia, Denmark, France, Ireland, Italy, Luxembourg, the Netherlands, New Zealand, Sweden, Switzerland, the United Kingdom, and the United States of America for their kind contributions to improving the livelihoods and food security of rural people in Myanmar. We would also like to thank the Mitsubishi Corporation, as a private sector donor.

PREFACE

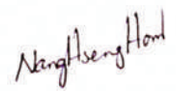
In Myanmar, development actors have created various approaches to support farmers, either through extension services and training to improve agricultural production, or through more direct interventions along agricultural value chains (the supply of finance, seeds, and other inputs, improvements in market access, and so on). Many have worked closely with farmers and have learned much about their practices and challenges.

However, this knowledge has not been adequately documented to support family farmers in ways that are contextually specific and responsive to farmers' own logic of production. As a result, agricultural development approaches have remained standardized and often designed in a one-size-fits-all mould. And in the context of Myanmar's rapidly-evolving agricultural sector, this is problematic. Indeed, farmers are now investing in agricultural machinery, adopting new crop varieties and modern seeds, becoming more mobile, shifting to non-farm activities and further integrating into new markets, even in remote areas. These transformations are highly dynamic and need to be properly examined. One of the hindrances to this has been the lack of analytical tools that would allow for an in-depth understanding of farm production systems in specific contexts.

This farming systems analysis guidebook has been conceived to address this shortcoming. It was developed out of the results and lessons learned from 18 months of work with LIFT implementing partners (METTA, IWMI, CDN, MIID, WHH, Gret) who agreed to conduct a farming systems analysis (FSA) with young scholars in six different areas, across five States and Regions of Myanmar with the technical support of Gret. Based on this experience, Gret developed this guidebook with the support of Yezin Agricultural University (YAU), in particular the Department of Agronomy, the Department of Agri-economics and the Department of Agricultural Extension. Most examples shown in this guidebook are extracted from the FSA studies that were conducted during this project.

The guidebook aims to provide methodological guidance for researchers wishing to conduct farming systems analysis. As a reference document, it is particularly aimed at students and development practitioners who have limited experience in conducting such exercises. In addition, the guidebook is conceived as a tool to promote dialogue between farmers, students, researchers and development practitioners.

We value this guidebook as an important milestone in the future curriculum development for YAU and for Myanmar professionals who are committed to providing effective support for the country's family farmers.



Dr Nang Hseng Hom
YAU Rector

Dr Myo Kywe
Chairman of National Education Policy Commission

Ms Katy Webley
LIFT Fund Director

Daw Myint Su
Gret-Myanmar Country Representative

Contents

List of figures

List of toolboxes

List of examples

List of abbreviations

AEZ	Agro-Ecological Zone
CDN	Consortium of Dutch NGOs
CPR	Common Pool Resources
CS	Cropping System
DoA	Department of Agriculture
FS	Farming System
FSA	Farming Systems Analysis
GIS	Geographic Information System
GP	Gross Product
Gret	Group of Research and Exchange on Technology
GVA	Gross Value-Added
II	Intermediate Input
IWMI	International Water Management Institute
LS	Livestock Rearing System
MADB	Myanmar Agricultural Development Bank
MIID	Myanmar Institute for Integrated Development
NVA	Net Value-Added
NGO	Non-Governmental Organization
WHH	Welthungerhilfe

GLOSSARY

Activity system is a combination of income generating activities at the household level. These activities can relate to farming (cropping, livestock rearing) or not (collection of Common Pool Resources (CPR), wage labour, self-employed or salaried agricultural occupation). It is perceived to be a system because the different income generating activities are inter-dependent and managed through a labour management strategy established at the family level. The convention adopted in this guidebook is to differentiate between farm activities (cropping, livestock rearing and aquaculture), CPR activities (collection of forest timber and non-timber products and capture fisheries), off-farm activities (agricultural wage labour outside of one's own farm) and non-farm activities (self-employed, salaried or wage-based activities outside the farming and CPR sectors).

Agrarian system is a theoretical expression of a historically constituted and geographically localized type of agriculture, composed of a cultivated ecosystem and a specific social production system comprising people, social relations and institutions *(Mazoyer and Roudart 2002)*.

Agro-ecological zone (AEZ) refers to a division of territory that has similar characteristics defined in terms of climate, landform, soils and land cover, and that has a specific range of potentials and constraints for land use (FAO 1996). An agro-ecological zone is the constitutive element of the agrarian system. It is not limited to agricultural land uses, and can also consist of forest, wetlands, grazing area, and so on, or a combination of several land uses (e.g. agro-forestry and agro-fishing). An agro-ecological zoning refers to the process of delineating the agro-ecological zones.

Common pool resources (CPR) activities relate to the collection and use of natural resources that are part of a resource base shared by a group of people, whether this resource is managed collectively by this group of people, by the State or is under any other forms of management.

Cropping system includes the crops planted (potentially as mixed cropping), crop sequences, and all of the techniques applied to them following a specific organization and under given soil and climate conditions *(Sébillotte 1976)*.

Differentiation is the action or process of differentiating or distinguishing between two or more things or people.

Family farming is a mean of organizing agricultural, forestry, fisheries, pastoral and aquaculture production which is managed and operated by a family and is predominantly reliant on family labour, both women's and men's. The family and the farm are linked, co-evolve and combine economic, environmental, reproductive, social and cultural functions *(Garner and de la O Campos 2014)*.

Farming system is conceptualized as an organized combination of production factors and activities geared towards agricultural production (both cropping and livestock) directed to self-subsistence and to sale. An examination of a farming system includes the study of relations existing between different elements of the system, notably the organization and distribution of family labour between the different production activities as well as relations between the different cropping and livestock systems *(Cochet et al. 2002)*.

Farming systems typology is a classification of farming systems based on differences in farm size (land area, size of herds, level of mechanization, and so on) and on the technical characteristics of the current cropping and livestock rearing systems. The farming systems typology is based on the differentiation processes between families in response to recent history.

Livestock rearing system integrates aspects relating to the herd structure (genetic characteristics, population pyramid, sex ratio, and so on), its feeding and the corresponding forage calendar, as well as herd management (movement, reproduction and care among other issues) *(Cochet 2015)*. Aquaculture (fish raising activities) is considered and conceived as a livestock rearing system.

Non-farm activities are conducted by any members of the family outside of the farming sector or sector related to the collection and processing of common pool resources (timber and non-timber forest products and capture fisheries). They include different types of employment: self-employment (own entrepreneur, taxi driver, and handicrafts and so on); salaried jobs (implying that the job is registered); or wage-labour. Non-farm activities might or might not include migration.

Off-farm activities are considered in this guidebook as agricultural wage labour activities. We use both terms interchangeably.

INTRODUCTION

Changing context in agricultural development interventions

Farming families account for a large percentage of the human population and for the majority of the population in developing countries *(Cochet and Devienne 2012)*. It is therefore important to develop good quality services to support them. In the 1990s, the withdrawal of the State in public interventions largely contributed to a decrease in resources allocated to support smallholder farmers. Since 2000, the new policies for alleviating poverty that have been introduced in many countries have revived a consideration of family farmers. However, farmers have mainly been viewed as part of "the poor" and considered as a target for development intervention rather than as central actors in economic development. At the same time, large-scale agricultural development has been promoted in agricultural development narratives and policies as more efficient and market-sensitive than family farming. Large-scale production is deemed capable of attracting the investment that the State does not have to develop rural areas.

Yet a growing number of studies and approaches have challenged these prejudices against family farmers and have reassessed the vitality and complexity of family farming. This body of literature affirms that family farms show great flexibility and adaptability and play a central role in society in terms of agricultural production (food and non-food), job creation in rural areas, and the preservation of diversified landscapes. Increased attention has also be directed towards an explanation of why not all farmers in a given region react in the same way to technical advice, innovations, policies, and so on *(Cochet and Devienne 2012)*.

In Myanmar, the country's opening and political transition, agriculture and agricultural value chains are evolving rapidly, along with comprehensive societal transformations. Anticipating the implications of such changes for family farms is crucial to help frame agricultural development interventions and policies that take family farmers into account more effectively.

Farming systems analysis: an approach to understand and support family farmers

Farming systems analysis is definitively part of the pro-family farmers' action-research agenda because it is an approach that helps in understanding the choices and practices of family farmers. It rests on a fundamental assumption that family farmers make rational choices, meaning that they always have at least one reason for doing what they do. The rationale of the approach is that a better understanding of family farmers' choices and practices would bring development partners to a position in which they could support their productive activities and aspirations more effectively.

Farming systems analysis aims to gain knowledge about the agrarian system of a particular region and the diversity of farms it encompasses, both in terms of resources endowment and technical choices in production. By taking into account the bio-physical, historic, socio-economic and technical context in which family farmers evolve, the farming systems analysis aims to understand the farms' structure and means of production (what they have), farmers' practices (what they do and how), the reasoning behind the decisions

Objectives of this guidebook

they make (why they do it), the technical and financial constraints they face and the results they attain (technical performance and economic outcomes).

The methods used in a farming systems analysis help to identify the processes of change underway in the region and the evolution paths of various farming systems. The approach is action-oriented (project identification, impact assessment) as it also aims to formulate hypotheses about how farms may evolve in the near future, and identify and prioritize the problems farmers encounter so as to support them in modifying their practices. Farming systems analysis seeks the greatest operational understanding possible of agriculture on the regional scale so as to define agricultural development interventions and measure their impact.

The direct audience of the guidebook consists of researchers and development practitioners – referred to in this guidebook as "researchers" – who are committed to supporting family farms. It aims to provide step-by-step guidance and basic technical support to improve the quality of farming systems analysis. The guidebook serves as a reference manual to support researchers on-the-ground by presenting a step-by-step process that specifies the tasks to be undertaken and the desired outputs. It is conceived as a reference document, easy to consult for quick orientation for those with only limited experience in conducting a farming systems analysis. While it aims to stimulate their understanding and creativity, it is by no means a substitute for more elaborate conceptual and theoretical foundations of agrarian system analysis.

The farming systems analysis can be beneficial to farmers themselves. As a direct benefit, the whole process can provide capacity development opportunities for them to reflect on their own practices and gain the "bigger picture" of the agricultural development issues in their region. Indirectly, the farming systems analysis may also benefit farmers as it builds knowledge about family farming and could help to formulate recommendations that might be taken up for their policies and programs by the government, development agencies or local action groups to support family farms.

Photo: Christine Schmutzler

PRESENTATION OF THE FARMING SYSTEMS ANALYSIS APPROACH

CORE PRINCIPLES OF THE FARMING SYSTEMS ANALYSIS

Farming systems analysis: an approach based on observation and dialogue

The approach requires attention and respect to nurture trust between the farmers and the researchers. The basis of what is proposed here is to observe and listen without pre-conceived categories and answers so as to avoid introducing biases into the analysis. Interviews should be a period of active listening to capture farmers' own knowledge and skills. This also offers a space for the farmers to step back and think through their own experience. For more information on principles for good interviews, *Toolbox 3*.
Besides key concepts, the design and implementation of the farming systems analysis are driven by core working hypotheses the researchers should always have in mind.

Farmers are rationale; they have "good" reasons to do what they do

In order to conduct farming systems analysis properly, it is crucial to avoid assuming that farmers' practices are backward, that they lack knowledge or are incapable of proper reasoning. Farmers usually take decisions in conformity with their interests, within the material, human and cognitive means to which they have access.

There is no one uniform category of farmers

Family farmers do not form a uniform category of actors. Even in a small subsistence-based region, it is possible to identify different types of farmers who have different strategies and practices and who react differently to the sets of constraints and opportunities they face.

Farming systems are dynamic

By recognizing recent changes and technical, economic and social transformations, it is possible to shed light on the key factors that lead to the evolution of each different type of farm, as well as to elucidate the differentiation processes among them in order to understand the major trends and trajectories of different types of farming households over time.

Farming systems analysis: an interface between research and development

It is important to envision the farming systems analysis within a wider social utility, and to consider its relevance to the rural population. This is particularly important when the analysis is conducted in conjunction with an NGO or a development project working to address a specific development issue. It is recommended that the farming systems analysis be framed with a particular agricultural development problem in mind, a particular question that represents a particular challenge for the local population and their supporters (development professionals, NGOs, and so on). In this way, the farming systems analysis can be seen as a research contribution to a concrete and real-life development issue *(Barral et al. 2012)*. Here below are just a few examples:

- Anticipate the interest and ability of family farmers to adopt an agricultural innovation within the agrarian landscape (e.g. agro-ecology farming practices, or the development of a new niche market)

- Guide the design and development of an inclusive water management scheme in a small watershed

- Understand the diversity of farming practices and rationale, and evolution pathways in the context of a local level land use planning exercise
- Understand the factors that trigger labour diversification outside agriculture and migration away from the village.

As a result, a key challenge for the person who conducts the farming systems analysis is to reconcile the scientific rigour needed for such an undertaking with the operational concerns co-formulated with the actors on the ground. It is a scientific and methodological challenge. It requires an understanding of the development issues at stake, the formulation of hypotheses as to why they have taken place, and the translation of these hypotheses into research questions to frame the farming systems analysis and to design specific investigation tools accordingly: the agro-ecological zoning, the agrarian history, the farming systems typology, and so on.

KEY CONCEPTS

Farming systems analysis is conducted through the use of a series of systemic concepts developed to study agrarian landscapes. Generally speaking, a system is a set of interacting or interdependent components that form a complex whole and are organized towards one or several objectives *(Crozier and Friedberg 1977)*. The systemic approach consists of delineating the boundaries of this object, its components, the interaction between them and the relationships that integrate each and every component into a more or less organized whole *(Figure 1)*.

In comparative agriculture, the concepts of the agrarian system, farming system, cropping and livestock system all deal with the exploitation of an ecosystem by humans *(Figure 1)*. These concepts help make sense of different agrarian units at different scales: the agrarian system addresses the interactions between an ecosystem and a group of people at the landscape level while the farming system deals with these interactions at farm/family level. The cropping or livestock rearing system refers to interactions at the plot or herd level. These concepts form a nested hierarchy, and a key characteristic of the farming systems analysis is to integrate these different levels of analysis. As *Figure 1* shows, the type of analysis and tools used to examine these different "systems" also vary according to the scale, ranging from detailed agro-ecological analysis at plot or herd level to wider socio-geographic and socio-economic analysis at landscape level.

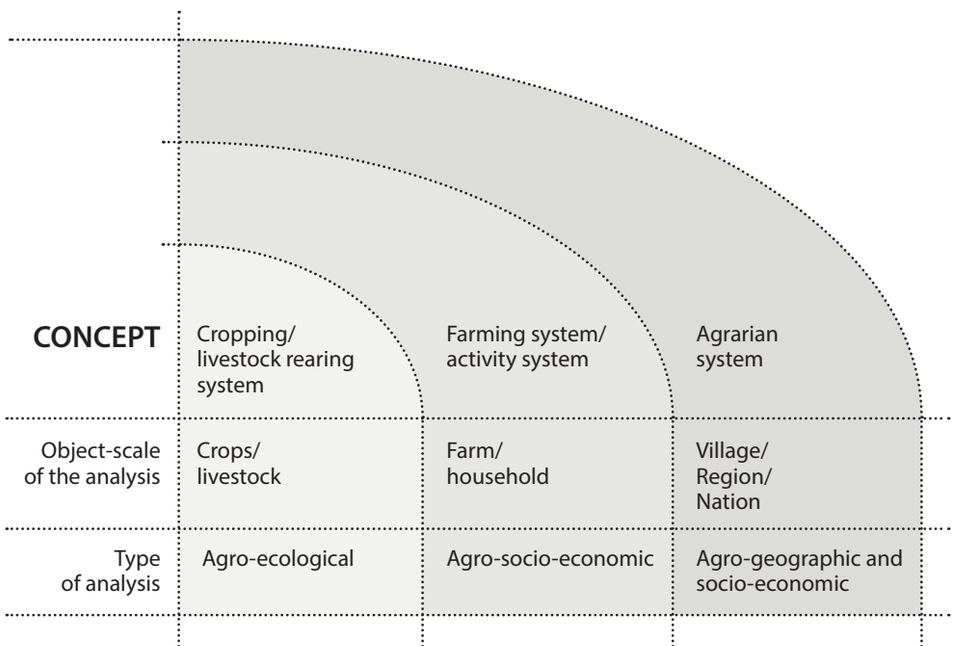


Figure 1—*Hierarchy of systemic concepts used in farming systems analysis, adapted from Cochet (2015)*

Agrarian system

The **agrarian system** is defined as the theoretical expression of a historically constituted and geographically localized type of agriculture, composed of a cultivated ecosystem, and a specific social production system made of people, social relations and institutions *(Mazoyer and Roudart 2002)*. The latter ensure the long-term fertility management of the cultivated ecosystem *(Figure 2)*. The agrarian system includes the following components: the cultivated environment and its historic transformations; the production instruments and the labour force implementing them; the social division of labour among farmers and the commercialization of the agricultural surplus including the trade relations with market actors.

The analysis of an agrarian system includes an examination of the social relations of production that shape the access to all means of production, as well as all the ideas and institutions ensuring reproduction of the system.

Agro-ecological zone

Agro-ecological zone refers to the division of territory that has similar characteristics defined in terms of climate, landform, soils and land cover, and that has a specific range of potentials and constraints for land use *(FAO 1996)*. An agro-ecological zone is the constitutive element of the agrarian system. It is not limited to agricultural land uses and can also consist of forest, wetlands, grazing area, and so on, or a combination of several land uses (e.g. agro-forestry and agro-fishing).

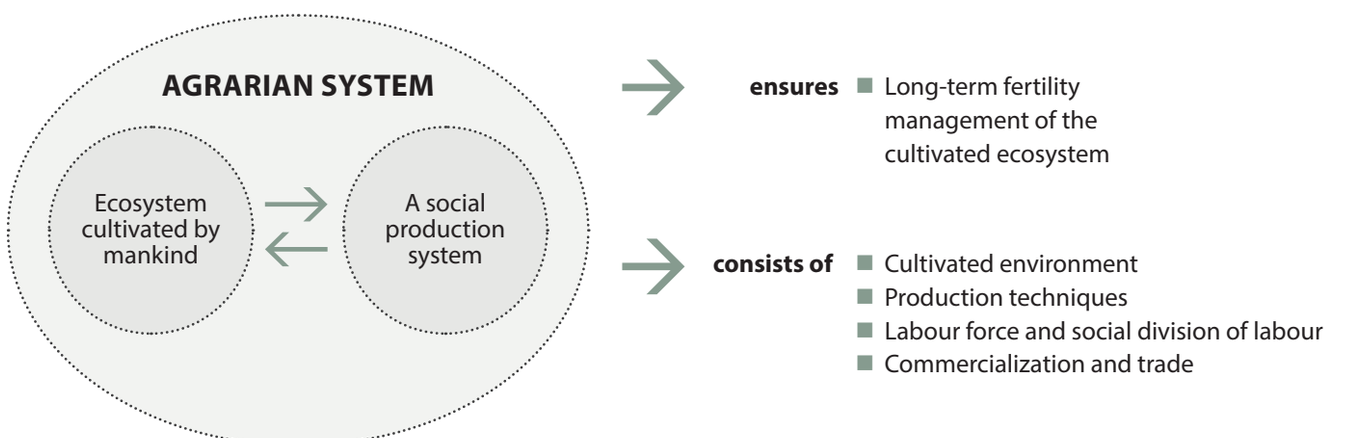


Figure 2—*Representation of an agrarian system*

Farming system (also known as production system)

There are many definitions of the concept of **"farming system"** but in this guidebook we address it at the level of a typical unit of production: the family.

A [family] farming system is conceptualized as an organized combination of production factors and activities geared towards agricultural production (both cropping and livestock) directed to self-subsistence and to sale (*Figure 3*). An examination of a family farming system includes the study of relations existing between different elements of the system, notably the organization and distribution of family labour between the different production activities as well as relations between the different cropping and livestock systems *(Cochet et al., 2002)*. As such, a farming system is influenced to varying degrees by political, economic, institutional and social forces that operate at many levels.

Cropping and livestock rearing systems

The **cropping system** concept applies to a plot (or a set of plots) cultivated in a certain way by the farmer. As such, it includes the crops planted (potentially as mixed cropping), crop sequences, all the techniques and labour applied to them following a specific organization and under given soil and climate conditions *(Sébillotte 1976)*.

On an equivalent scale of analysis, the **livestock system** is defined at the level of the herd, and integrates aspects relating to the herd structure (genetic characteristics, population pyramid, sex ratio, and so on), its feeding and the corresponding forage calendar, as well as herd management (movement, reproduction and care among other issues) *(Cochet 2015)*. This also includes aquaculture, although capture fishery would fall under the activity system.

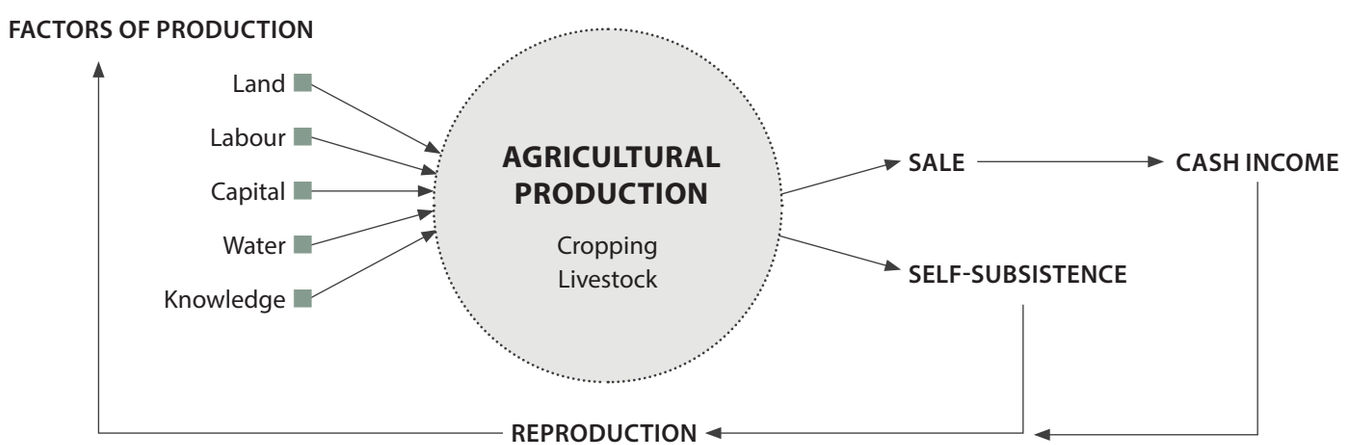


Figure 3—*Representation of a farming system*

Activity system

In most of rural Southeast Asia, however, the occupations of a household are not limited to cropping and livestock rearing. The activity portfolio of most family farmers also comprises wage-related activities, sometimes involving migration, and also self-employed activities in agricultural processing or other services. It further encompasses the activities associated with the harvesting and management of natural resources, such as fisheries or forest related products (timber and non-timber forest products). As much as cropping and livestock activities, the conduct of these activities is based on factors of production, in particular technology and khowledge. In fact, the non-agricultural activities are increasingly important to family farmers in Southeast Asia. They usually do not replace farming activities *per se* but are integrated by families based on their demographic structure, labour capacity, investment capacities, interest and skills, all embedded in a wider ensemble including the security of land tenure, matrimonial strategies, ideological conceptions, the structure and functioning of commodity markets, and so on. The combination of these income generating activities at the household level is called an **activity system** (*Figure 4*). It is conceived as a system because the different income generating activities are inter-dependent and managed through a labour management strategy established at the family level.

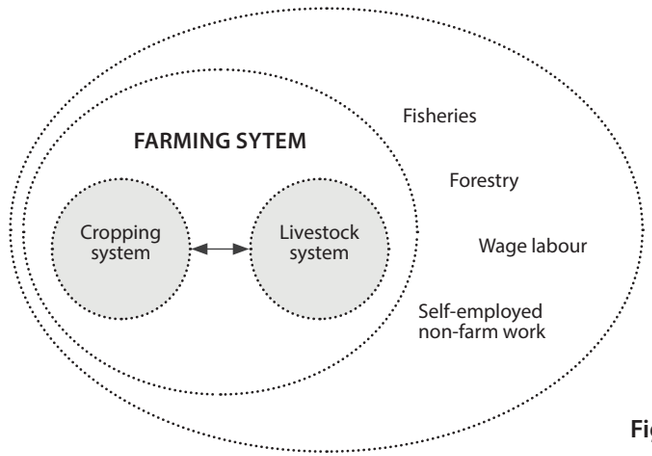


Figure 4—*Representation of an activity system*

THE APPROACH IN A NUTSHELL

Overall, a farming systems analysis is articulated under four main phases as shown in *Figure 5*: 1) Understand the agrarian landscape; 2) Study the agrarian history and identify farming systems; 3) Analyze the cropping and livestock rearing systems and other income-generating activities; and 4) Assess the economic performance of farming systems. As such, the analysis relies on an interdisciplinary and holistic approach that will necessitate the combination of qualitative as well as quantitative field research methods and tools *(see the synthesis in Annex 1)*. It requires researchers to be equipped with a sufficient skillset in various disciplines, adequate knowledge in different fields of interest (e.g. history, soil science, socio-anthropology, agro-economics) as well as a suitable personality and sensitivity to conduct field work in a humble fashion and engage in a real dialogue with farmers. It is not always easy for researchers to mobilise all of these requirements in terms of skills, knowledge and behaviour. A transversal element across the approach is the need to regularly present and discuss the preliminary findings of the research to local resource people. It is crucial for them to validate the findings to make sure that the agro-ecological diversity is well captured, the agrarian history as reconstructed makes sense from a local perspective, the specificity and knowledge actually elaborated and transmitted by farmers is well considered, that agricultural innovation is well understood and so on. For this reason, we suggest that seeking validation should be a continuous process throughout the farming systems analysis.

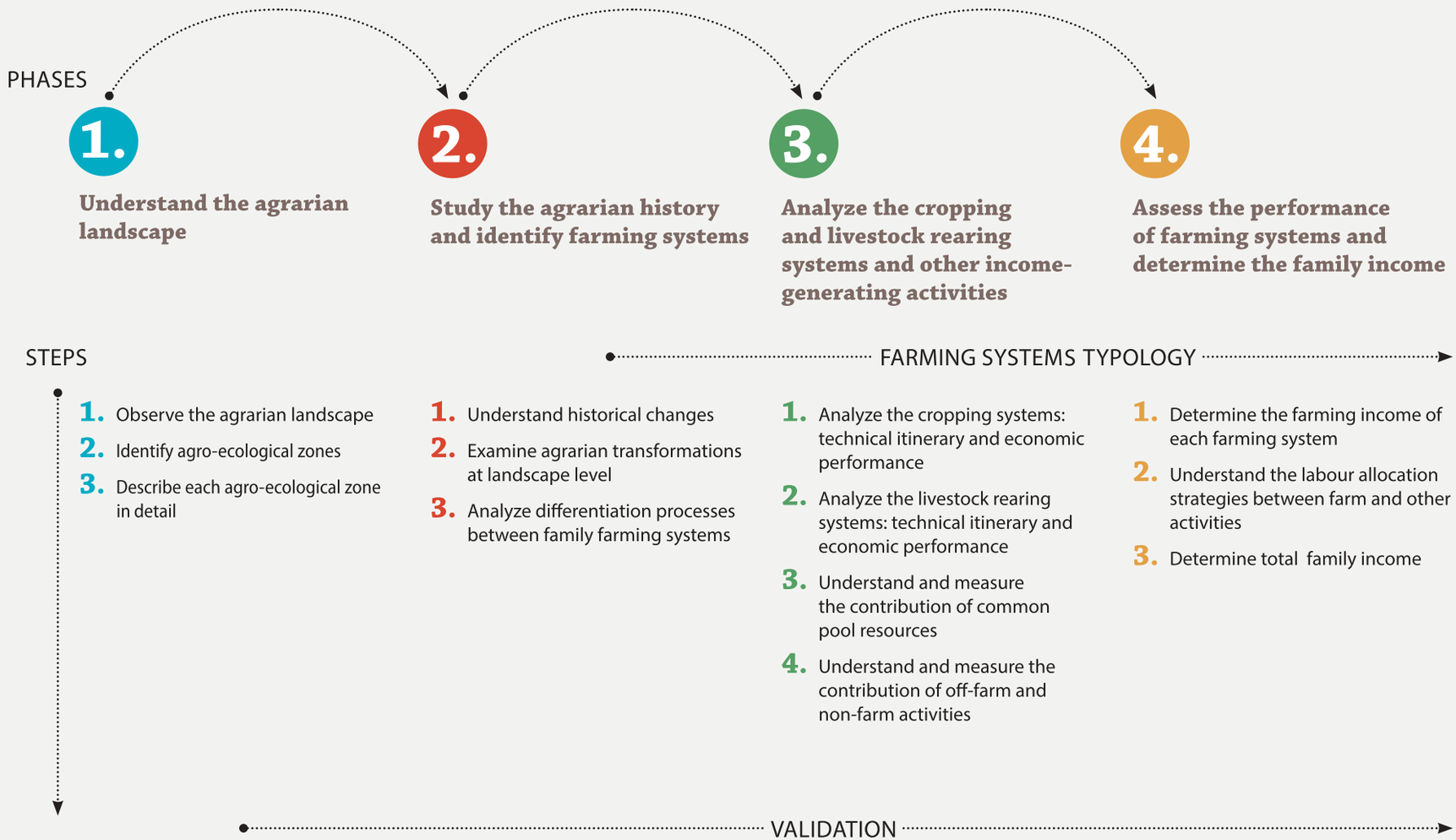


Figure 5—*Phases and steps in the farming systems analysis*

1.

Understand the agrarian landscape

Understanding the agrarian landscape consists of a detailed and organized set of observations of the different agro-ecological units of which it is constituted: their internal characteristics, spatial arrangements and the possible relations between them.

These observations are made at different scales and allow the formulation of hypotheses about the nature of the activities and land uses in the agrarian landscape and the most recent changes it has undergone. Observations about cropping practices apply mainly to cropping systems, while observations about grazing activities provide information about livestock rearing systems as well as interactions between cropping and livestock systems. The examination of the spatial organization of different cropping and livestock systems with other land use types informs an understanding of the agrarian landscape.

Identifying and analysing the agrarian landscape is a crucial but demanding exercise. Observation needs to be made in a systematic manner, organized, classified and, ultimately, modelled with the help of one or more meaningful and comprehensive illustrations such as transects or diagram blocks.

2.

Study the agrarian history and identify farming systems

In order to identify the diversity of farming systems that populate the study area, the researcher now needs to understand the agrarian history of the study area, an endeavour that is the second main building block of a farming systems analysis. The aim of the historical analysis is to understand the evolution of the land use in connection with changes in agricultural policy, changes in agricultural techniques, and the wider transformation of the economy. It is quite likely that the impacts and influences of these changes are different across the study area, so it is useful to examine the agrarian history in light of the agro-ecological zonation established earlier.

In fact, the characteristics and decisions of any particular type of farm necessarily fall within a limited number of possibilities that reflect the distant and recent agrarian history of the landscape. For this reason, it is important to identify the main differentiation mechanisms that explain why, when and where certain households have followed certain trajectories of evolution, while others have taken other directions. The review of these mechanisms of differentiation helps to establish a classification of main farming systems models that is based on a combination of different cropping and livestock rearing systems.

This classification is usually referred to as a farming systems typology.

An effective method of elaborating the typology of farming systems requires general knowledge about the changes in land and agricultural policies (including the very important question of access to land), the introduction and uptake of new agricultural techniques or innovations (e.g. irrigation and the introduction of new crop markets), the changes in the management of natural resources that have important impacts locally (e.g. out-migrations, the development of the non-farming economic sector, and so on).

The establishment of the typology also requires general knowledge about how farms currently operate: the size of landholding and herds, the combination of different cropping and livestock systems in the agrarian landscape, the level of mechanization, reliance on paid external labour, and so on. The idea is to identify the farming systems before beginning to study in detail how they operate. This method enables a choice to be made about which farms will be studied in detail.

3.

Analyze the cropping and livestock rearing systems and other income-generating activities

At this stage in the process, it is important to take a close look at the various cropping and livestock systems that constitute each farming system as well as the variety of other income-generating activities in which family members are involved.
The analysis of the cropping systems implies a detailed description of the crops planted (type of seeds and provenance of the materials), the crop association and succession, and all the techniques applied following a specific routine and under given soil and climate conditions (soil preparation, ploughing, application of fertilizers and phyto-sanitary products, harvesting and processing).
A detailed description of labour input for all of these operations, as well as a calculation of the economic performance of each cropping system, is particularly important to document.
As far as the livestock system analysis is concerned, researchers need to examine the practices of aggregation (constitution of units or batches, groups of animals that will be treated specifically according to their sex or age category, and that are related through animal flows), management (reproduction, health and feeding), farming (taking milk, wool, meat and more from the herd), and renewal of the herd (culling, selection of young animals or purchase for renewal purposes) *(Cochet 2015)*.
A detailed description of labour input for all of these operations, as well as a calculation of the economic performance, is also needed.
The calculation of the economic performance of each cropping and livestock system rests on the notion of value-added, which measures the wealth created by the system. It equals the difference between the gross output and the value of Intermediate Inputs (II) that are consumed fully during the production process.
The value-added serves to assess the productivity of the factors of production: the value added per worker or per man-day measures the productivity of the labour engaged, whereas value-added per hectare (or "land productivity") reveals the more or less intensive nature of the system.

This step also includes the review of all other off-farm and non-farm activities carried out by all the family members. These can indeed be very diverse and play an important role with regard to the formation of family income. These activities include the harvest of common pool resources (capture fisheries and forestry), off-farm and non-farm activities (*see glossary for working definitions*). These activities might require seasonal or permanent migration, in which case the remittances transferred from the migrant work might be a source of income for the family in the village. A detailed description of these activities includes labour allocation, the interest of the family in these activities, a description of which family members are engaged in these activities, the conditions of employment, the networks established between the household and the outside community through these activities, the income generated and the possible costs incurred.

4.

Assess the performance of the farming systems and determine the family income

The analysis does not end with the identification of a farming systems typology and the description of how each cropping and livestock system operates technically and performs economically. It is also important to assess the economic performance of each farming system. The farm income is defined as the part of the value-added left to the family after payment for the different services necessary for rearing livestock or cultivating crops: the payment of land rent fees, the payment of the external wage workforce, the payment of interest on borrowed capital and the payment of taxes on land or products. In other words, the farm income results from the distribution of the value-added between the different operators involved in the production and depends on the conditions of access to resources mobilized in the production process. Where relevant, it is also important to detail the support received by the farmers through subsidies. Comparing the total farm income per worker to the opportunity cost of the workforce brings the evolution of each farming system into perspective. The calculation of the farm income also gives a reliable indication about the degree of reproduction of the different farming systems: those that generate enough resources to grow and invest, those that just make ends meet or, in contrast, those that are unable to ensure the basic reproduction of the system.

Additionally, it is central to analyze the strategies guiding the allocation of family labour between all activities (farm, off-farm, CPR and non-farm). The key questions to be asked here are: Who does what? When? and Why? To answer these questions, it is useful to establish a family labour calendar that identifies the occupations of each active labourer throughout the year, the labour peak and lean periods, and the way each family deals with them. It is also important to understand the interaction between each system, for instance the fertility transfer from livestock to cropping systems, the use of off-farm income to support agricultural innovation or, in contrast, the use of farm income to invest in non-farming activities. Ultimately, the income generated by these different activities, farming and non-farming, needs to be integrated within total family income to provide a comprehensive picture of the capacity of each family to meet their livelihood needs.

RESEARCH TOOLS AND METHODS

Delineation of the study area

The agrarian system concept is used to classify and characterize the agriculture of very large geographical areas *(Mazoyer and Roudart 2002)*. However, a farming systems analysis is conducted on a smaller territory comprising a number of villages or communities of people sharing the same resource base. A typical issue in conducting a farming systems analysis is the delineation of the study area. It has to be large enough to include a diversity of agrarian situations and small enough to examine farming systems in detail. In fact, there is no rule about the recommended size for conducting a farming systems analysis, nor is there a particular standard in respect of the recommended acreage, number of villages or household sample size of the study area.

A flexible and pragmatic approach should be followed to delineate the study area:

- The study area includes a diversity of land uses valorized by the particular group of people. It is not limited to agricultural land but also consists of all other land uses (e.g. forest, wetland, fisheries grounds, grazing lands, built-up areas) that are used and shared by a defined group of people;

- A result of the previous criterion is that it is often more relevant to select an area following natural rather than administrative boundaries
- The study area should not be too large so that the farming systems to cover are not too many and can be properly documented, within the time available, and in accordance with financial and other constraints
- The study area enables the practitioner to capture a diversity of situations to answer the specific research problem identified (if any)
- The study area should also be delineated as an area where conflicts associated with agriculture can be grasped *(Deffontaines 1991)*.

Selection of villages

The selection of villages to be studied is not a one-off process. The number of villages selected very much depends on the purpose of the analysis and may vary throughout the research process. In the agrarian landscape analysis phase, the researcher might explore a higher number of villages in order to cover the agro-ecological diversity of the area. As the researcher moves forward through the steps and level of detail of the farming systems analysis, he/she will need to go into more specific issues and, for this, he/she may select a more limited number of villages *(Figure 6)*.

Likewise, as he/she proceeds through the exercise, the selection of households for interview will be based on increasingly specific criteria. When it comes to fine-grained and detailed economic analysis, it is usually recommended that a more limited number of villages (and families) is selected due to the time required for this *(Figure 6)*.

PHASES *of farming systems analysis*	NUMBERS *of villages selected (indicative only)*
1. Understand the agrarian landscape	10 - 15
2. Study the agrarian history and identify farming systems	5 - 10
3. Analyze the cropping and livestock rearing systems and other income-generating activities	3 - 5
4. Assess the performance of the farming systems and determine the family income	3 - 5

Figure 6—*Selection of villages in the farming systems analysis*

Time requirements

A full-fledged farming systems analysis is a relatively lengthy process as it requires the analysis and integration of a large number of factors that are not necessarily easy to grasp in a quick assessment survey. Also, the outputs of the process are contingent on the familiarity of the researchers with the study area, and their need to gain the trust of the local communities. Again, this requires time.

The classical FSA approach, when conducted individually by university scholars, often take five to six months with intensive field work (four to five months) and sufficient time (one to two months) for data processing, analysis and report writing.

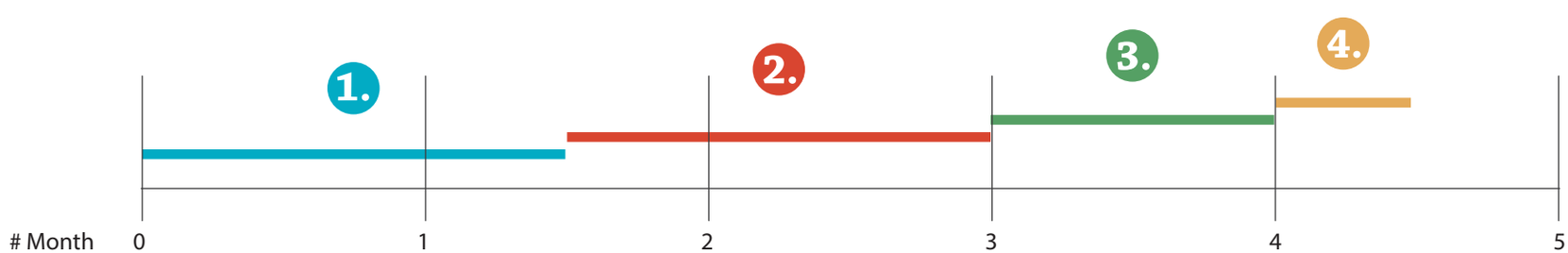
The first three phases are particularly time consuming as they require a considerable investment in fieldwork, and meetings with villagers and farmers.

The time needed for each phase is given below as a rough estimate:

- Understand the agrarian landscape: **1 to 1.5 month**
- Study the agrarian history and identify farming systems: **1.5 month**
- Analyze the cropping and livestock rearing systems and other income-generating activities: **1 month**
- Assess the economic performance of the farming systems and determine the family income: **2 weeks**.

To cope with time issues, it is also possible to "hybridize" the FSA approach with rapid appraisal methodologies such as Participatory Rural Appraisals (PRA). However the output would of course be very different and would not be as detailed and comprehensive as a "classical" FSA report. For example, it can be very relevant in certain cases to conduct a rapid "FSA" following the same methodological sequence (landscape analysis, history analysis, analysis of cropping systems and livestock systems and activity systems, analysis and comparison of farming systems) using participatory tools and regular validation processes with the community.

If the farming systems analysis is conceived in the context of a particular development project, one could easily use a full-fledged FSA as a baseline survey to become familiar with the context and formulate the project objectives and a "rapid FSA" as a mid-term and final evaluation tool to assess the progress and impact of the project.



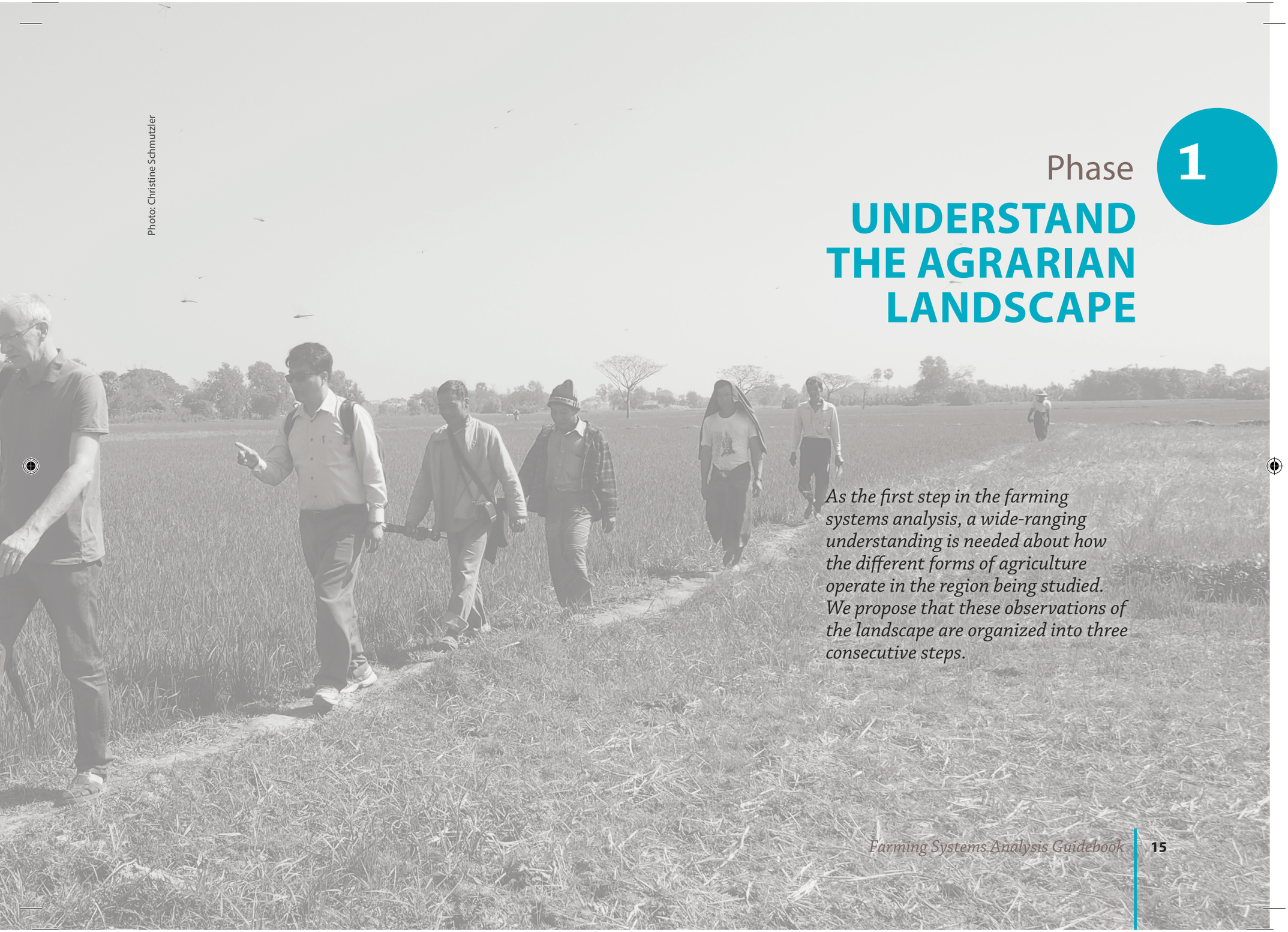


Photo: Christine Schmutzler

Phase 1

UNDERSTAND THE AGRARIAN LANDSCAPE

As the first step in the farming systems analysis, a wide-ranging understanding is needed about how the different forms of agriculture operate in the region being studied. We propose that these observations of the landscape are organized into three consecutive steps.

STEP 1.1
OBSERVE THE AGRARIAN LANDSCAPE

SCOPE AND CONTENT

In this initial phase, it is necessary to observe the landscape as a whole. This requires looking beyond crops and livestock and observing all the different land uses of the agrarian landscape.

Topography and geomorphology

- Identify the main topographic structures of the landscape: variations of elevation and terrain slopes
  - Identify areas with steep escarpments where soil erosion is potentially a problem
  - Identify flat lowland where flood is potentially a problem
- Identify particular forms of the landscape such as dips, valleys, glacis, rock outcrops, and so on
- Identify, if relevant, the main element of the watershed such as the water body or watershed boundary
- Generalize this information and identify landforms where relief and slope present relatively uniform patterns.

Soil

- Identify any different types of soils
- Characterize these soils to the extent that is possible: colour, texture, depth, humidity, structural stability, sensitivity to erosion, stone content, characteristics of the bedrock, and so on.

Hydrography and climate

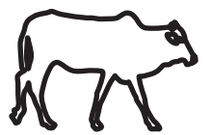
- Identify the main bodies of water resources (e.g. rivers or streams, lakes, ponds, springs, ravines, marshes and wetland)
- Identify the water status of these water bodies (permanent or intermittent)
- Identify variations in water flow in the landscape (e.g. seasonal floods)
- Identify visible signs of drought or flood.

Vegetation

- Identify the different land cover elements of the landscape (e.g. natural vegetation, cultivated areas, fallow land and grazing land)
- Forest: description, types of trees, density, degree of fragmentation, location, and signs of use or of land left fallow
- Shrubs vegetation area: size, description, location and use (grazing, cutting for fodder, left fallow)
- Grass land areas: size, grass species, description, location and use (grazing, cutting for fodder, left fallow)
- Perennial crops: types (orchards, hedges, or trees scattered in the fields) and tree species
- Annual crops: size of the fields, types of crops and mixed cropping practices, plant densities, tillage and other agricultural practices, as well as the plant development stage on the observation day. In rice cultivating area, identify the different types of rice fields (e.g. deep-water, rain-fed, irrigated)
- The relative proportions of the various types of land use as well as their areas plus spatial arrangements.

Cultivated areas

- Identify the size and structure of the plots
- Characterize plot fencing (banks, ditches, trenches or furrows, drainage or irrigation facilities, spring water catchments, fences, hedges, dry walls, living fence, and so on)
- Identify any evidence of cropping practices, e.g. indications that the land has been cleared (stumps) or burnt (ash, coal), or that it has been ploughed, hoed or weeded, or that the trees have been pruned, and so on
- Identify any installations, improvements or developments that have been made to enhance cultivation and cropping practices (e.g. irrigation schemes: water sources, nested hierarchy of canals, gates and pumps, command perimeter, and so on)
- Identify the diversity of agricultural tools (manual and mechanical) used to conduct agriculture.



Animals

- Identify any signs of wild animals
- Identify main livestock activities
  - Type (species and breeds) and number
  - Equipment for rearing activities: free, kept in home garden, cared for by herdsman/woman
  - Grazing activities (pasture, cultivated fields)
  - Source of alimentation for livestock
  - Ascertain whether the animals are used for cultivating the land.

Settlements, built-up areas and transport infrastructure

- Identify the spatial structure of the settlement area (lineal along transport infrastructure, nuclear, scattered, and so on)
- Identify the main characteristics of the housing (building materials, houses on stilts, storeys)
- Identify any built-up structures outside the main village and their functions (animal pens, temporary encampments, warehouse, and so on)
- Identify the different types of storage and processing facilities for agricultural products
- Identify if anything has been installed close to the settlement (drainage facilities, wells, fences)
- Characterize transport infrastructure: road types/surface (bitumen, hard-surface, dirt road), and accessibility in rainy and dry season.

1

METHODS

To conduct this first step, a mix of primary and secondary data and information are required.

Primary data

At this stage, it is recommended to collect visual observation rather than conducting interviews or focus group discussions. All the characteristics of the landscape are collected primarily through visual observations, listening, immersion in the environment and daily note-taking. The observation of the landscape relies on a series of tools the researcher needs to combine, based on his/her knowledge and interests:

- Visual observations (field note-taking and drawing sketches)
- Observation from high viewpoints (e.g. the top of a hill or mountain)
- Map sketching
- Photographs that can be annotated with arrows and text
- The geological and soil observations can be made in places where soil or rock profiles are visible, such as along river banks, along the sides of roads or paths, on rocky outcrops or in areas where the vegetation has disappeared as a result of erosion.

Secondary data

Where relevant or necessary, the researcher can use secondary information to conduct the observation of the landscape. It might be useful to cross-check and validate field observations and interpretations with secondary sources of information — such as topographic-soil-geological maps, weather information (temperature and precipitation) — to develop an ombrothermic diagram (temperature and precipitation figure)[1], or to take advantage of the updated satellite imagery available on the Google Earth server (***www.googlearth.com***) or Google Earth Engine (***https://earthengine.google.com/***) for the more experienced users. For Myanmar, you can also download many maps from MIMU: ***http://www.themimu.info***

DESIRED OUTPUTS

- As this information collected in the field will be used throughout the farming systems analysis, it is important to keep detailed records of all of your field observations and to organize them based on the themes identified above. This can be done by means of diagrams, tables, photographs, sketch maps or maps to scale (if researchers have the necessary skills to use or produce them)
- The illustrations of the landscape can be based on a particular theme of interest, or several themes can be integrated in order for interactions between different elements of the landscape to be appreciated, e.g. land use and soil types (*Example 1 or Example 2*).

1 For instance: ***http://www.freeware-archiv.de/BeCyClimate-Wetter.htm***

Example 1

Sketch land use map in a Myanmar village

Illustrations by Allaverdian et al. (2017)

This is a village resource map sketched by a local researcher to help visualize the main resources and their spatial arrangement in one village of the study area. The map was drawn with the help of local villagers.

1

1

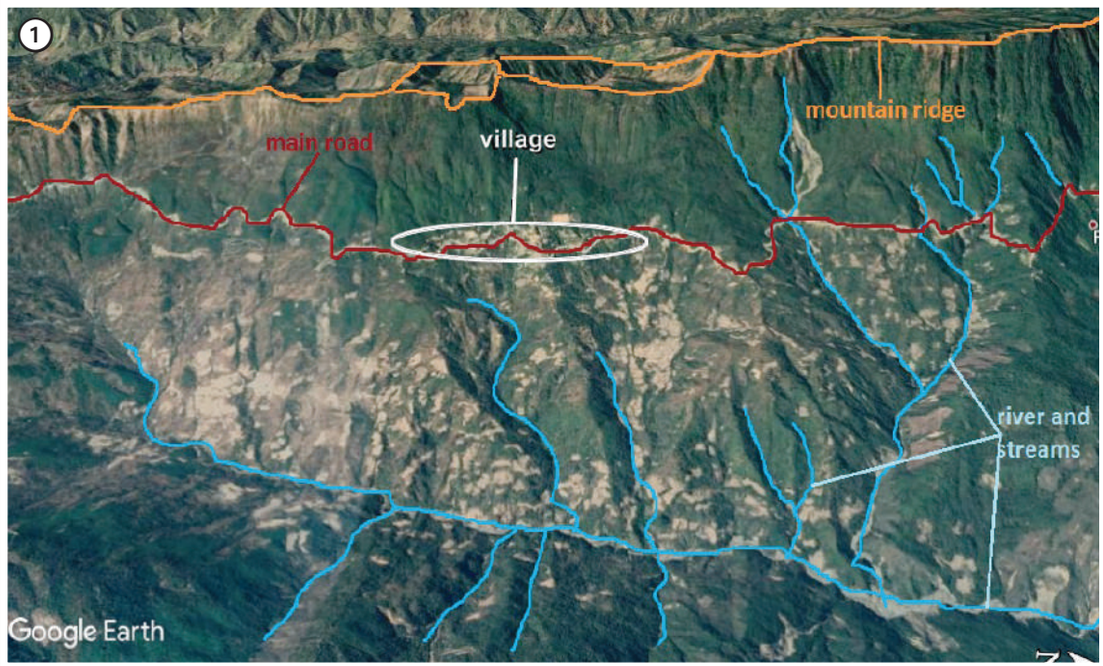
Example 2

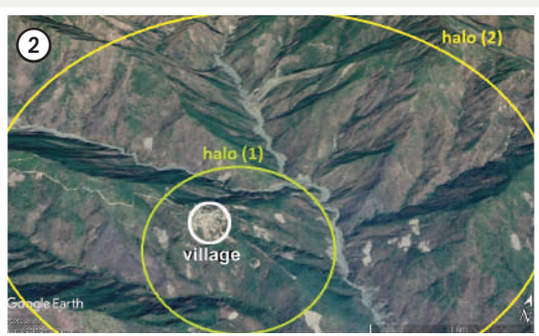
Spatial organization of a village Chuncung and its surroundings

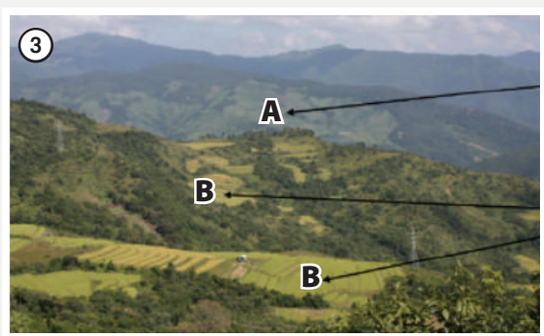
Hakha Township, Chin State, Myanmar
Illustration and photographs by
Clarisse Frissard and Alyssa Pritts, 2018

Image (1) is a view of Chuncung village territory with its valleys and network of streams that was acquired from Google Earth. It helps give an understanding of the spatial organization of the territory in relation here with its topography, the location of the village, transport axes and water bodies

Satellite view (image (2)) and photographs (image (3)) provide detailed information about the organization of the agricultural hinterland around the main village. Both illustrations differentiate two different areas: halo 1 consisting of rice terraces and permanent fields (foreground of the photograph) and halo 2 consisting of shifting cultivation plots (lopils) (background of the photograph).







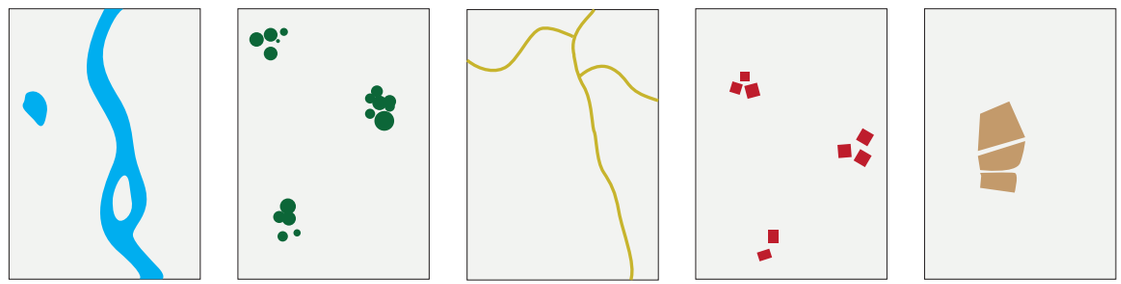
A *shifting cultivation*

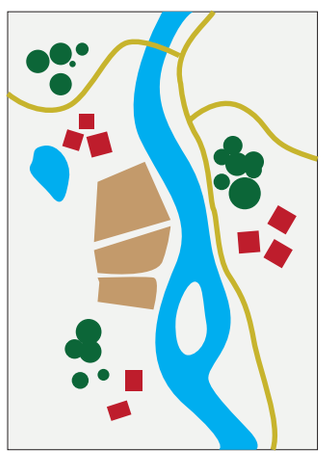
B *Paddy terraces*

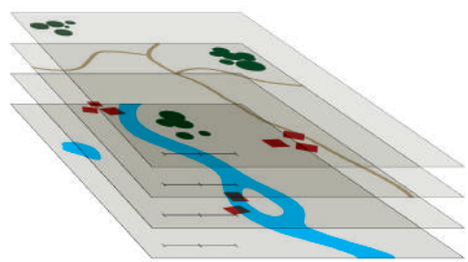
STEP 1.2
IDENTIFY AGRO-ECOLOGICAL ZONES

SCOPE AND CONTENT

The landscape observations, map readings and walks through the area now facilitate the agro-ecological zoning (AEZ). An agro-ecological zone relates to a territorial unit within which the biophysical characteristics and land use are relatively homogenous. These units must therefore be identified and described based on their biophysical and the land use/cover characteristics. For the methods to delineate an agro-ecological zone, see *Toolbox 1*.







METHODS

The agro-ecological zoning (AEZ) exercise proceeds by overlaying ("mentally" or assisted by GIS) different layers of information related to the biophysical properties and land cover/land use of the agrarian landscape (topography, geology, soil condition and hydrology).

The agro-ecological zoning depends on a large number of criteria, and different agro-ecological zones could be identified depending on *a priori* judgments of the researcher. It is then important to realize the exercise in the context of the specific and real-life development issue that frames the farming systems analysis (*Example 3* below presents an agro-ecological zoning conducted to understand the conditions of access to water in the dry zone).

DESIRED OUTPUTS

- A zonation diagram (hand-written illustration or a map) that differentiates clearly the different agro-ecological zones and, for each zone, the different types of land use *(Example 3)*
- A preliminary narrative or tabular descriptions of each zone against its biophysical and land use/land cover components

1 Toolbox 1—How to realize an agro-ecological zoning?

Start from the guiding research question

An AEZ exercise may lead to a multiplicity of outputs depending on the criteria used. But for the sake of consistency, it is important that the AEZ be useful for the rest of the analysis. This is the reason why we recommend setting the AEZ criteria according to the research problem that guides the farming systems analysis (*see above*).

Identify the main land use types observed in the study area

Based on the observations of the landscape conducted earlier, identify a range of land use types that reflect the current diversity of land occupation in the study area. A land use type is defined as a particular arrangement of crops — or a range of crops — livestock rearing, and any other natural resource land use units (forest, wetlands, grazing and so on). Ideally, the identification of main land use types can be made on a map (sketch, or a map to scale if assisted by GIS).

Represent the different agro-ecological elements as individual layers of information

Each of the agro-ecological elements that form the landscape, e.g. water resources, elevation, slope, soil and geology (*Example 3*), is extracted from separate layers of information and drawn on a sketch map (or a map to scale). It is important to respect the proportions (or the scale) so that the different layers can be overlaid spatially afterwards. It is important here to select these layers of information in step with the agro-ecological criteria set forth earlier.

Overlay the layers and delineate each agro-ecological zone

The land use types and the different layers of information generated earlier are then overlaid in order to identify overlap and correspondence between the different layers of information (land use, water, elevation, slope, soil, geology, and so on). In order to "read through" the different layers, the use of tracing paper is recommended.

Progressively, the exercise will allow for the identification of areas where the characteristics of the different layers are more or less uniform. This is the agro-ecological zone.

Transect walk

A transect walk (*Toolbox 2*) might be useful to check the agro-ecological zoning on the ground and in particular the boundaries between different zones.

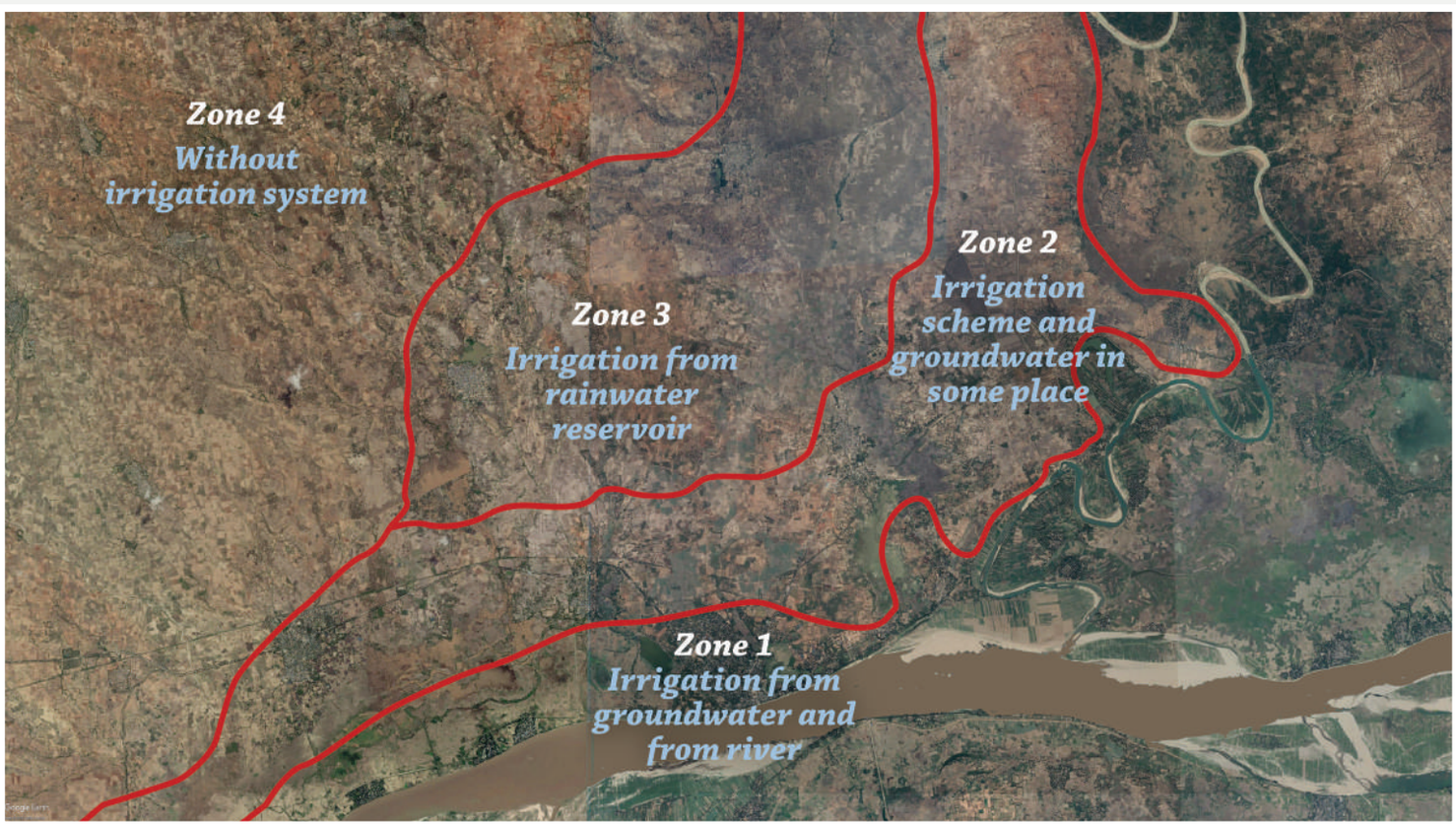
Example 3

Agro-ecological zoning

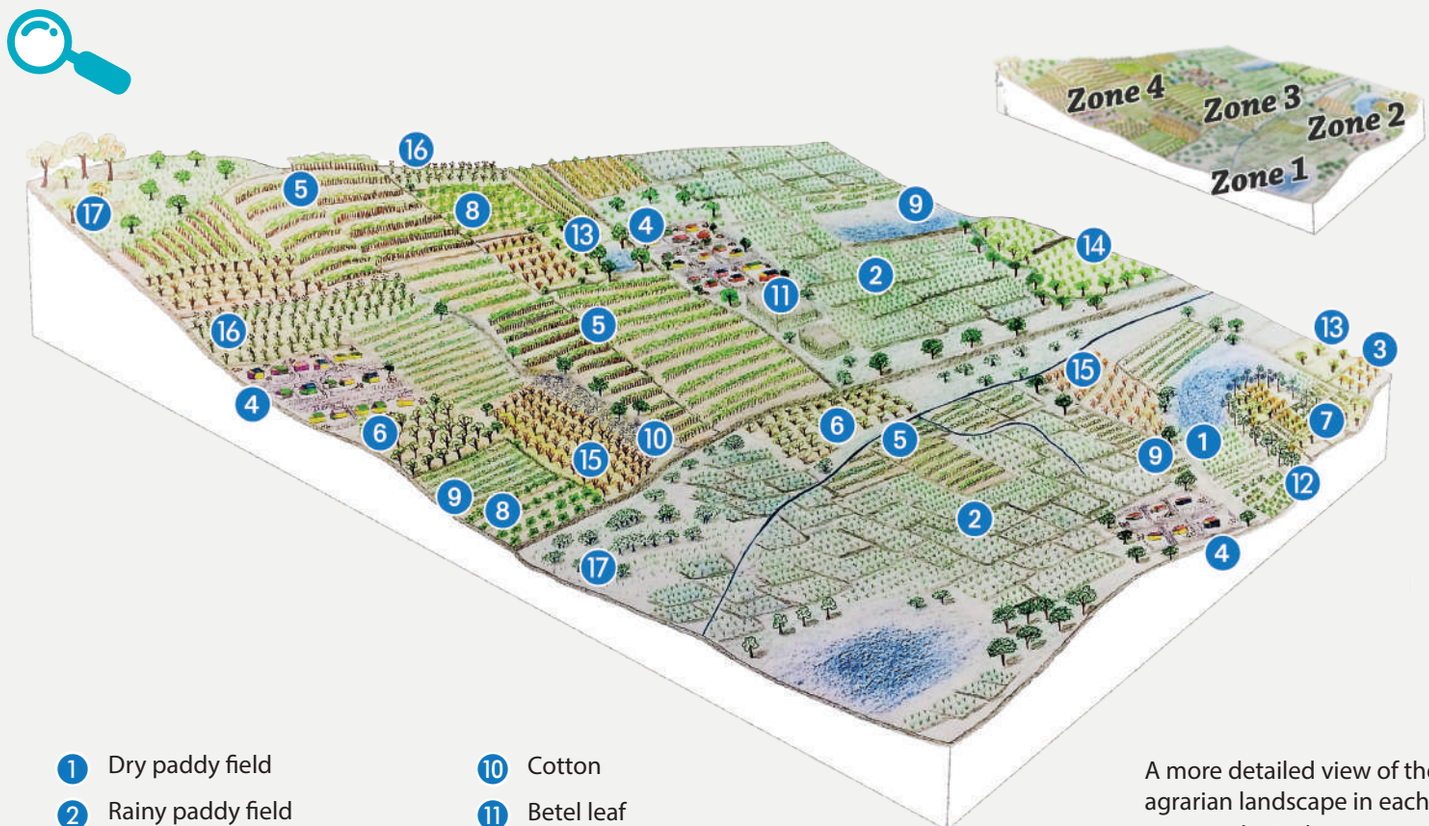
Myinmu Township, Sagaing Region, central dry zone of Myanmar
Adapted from Fue YANG, 2017

Four different zones, depending on topography and cropping system, are identified:
1) Wetland and river terraces; 2) Lowland zone; 3) Middle zone and 4) Upland zone.

As the farming systems analysis conducted in the area aimed to understand the different conditions of water use in agriculture, each of these zones is characterized by the main type of access to irrigation water.



1



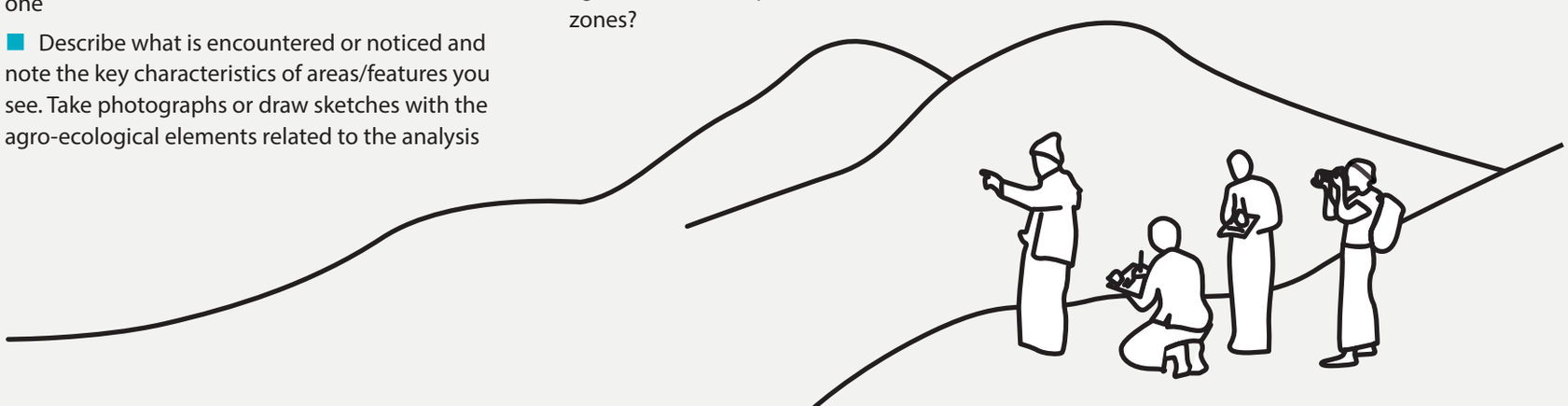
1. Dry paddy field
2. Rainy paddy field
3. Eugenia trees
4. Villages
5. Pigeon pea plots
6. Thanakhar tree plantation
7. Bananas
8. Groundnuts
9. Green gram
10. Cotton
11. Betel leaf
12. Vegetable in river terraces areas
13. Mango trees
14. Wheat
15. Sesames
16. Sorghum
17. Forest and natural pasture

A more detailed view of the diversity of the agrarian landscape in each of the four general agro-ecological zones.

Toolbox 2—How to do an agro-ecological transect?

- Form a group of participants including local folk who are knowledgeable about the agriculture of the studied area
- Agree with participants on the route to follow during the walk. The route should cover the different agro-ecological zones. If necessary, the route can meander rather than proceed in a straight line. It is often necessary to conduct several transect walks to gain fine-grained information about each agro-ecological zone
- Start at the edge of the area. As the walk progresses, stop at key features or borders of a new zone and observe the transition to the next one
- Describe what is encountered or noticed and note the key characteristics of areas/features you see. Take photographs or draw sketches with the agro-ecological elements related to the analysis
- Additional questions to be discussed with participants include:
  - What are the major activities carried out in the zones? By whom?
  - What services and infrastructure are available in the zones?
  - What are the main crops and natural resources available in the zones? Who uses them and for what purposes?
  - What interventions for improvement have been made?
  - What are the key constraints affecting the agricultural development of the different zones?
- After the transect walk, discuss and record the information and data collected with participants
- Where more than one transect walk has been completed, results can be combined and compared to develop a sense of the agro-ecological diversity of the entire study area
- Prepare a transect walk diagram on a large sheet of paper to feature the different information collected (plants, land use, problems, drainage system, and so on).

Source: adapted from FFI, 2013. www.fauna-flora.org/wp-content/uploads/Transect-Walk.pdf



1 STEP 1.3 DESCRIBE EACH AGRO-ECOLOGICAL ZONE IN DETAIL

SCOPE AND CONTENT

The researchers conduct additional field work when necessary and synthesize information derived from landscape observation in a concise and precise narrative.

METHODS

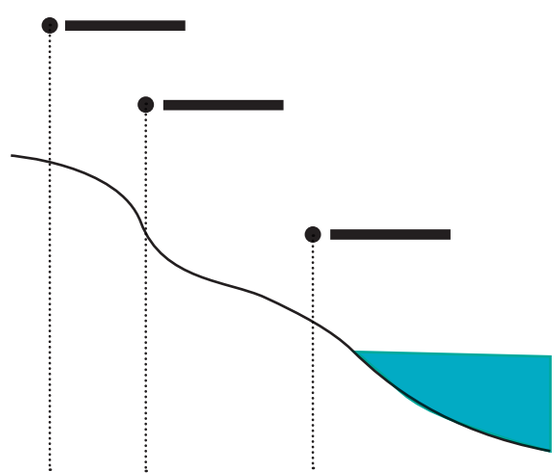
- An agro-ecological transect walk offers a useful way to gather information about the agro-ecological diversity and variations across the agrarian landscape *(Toolbox 2)*
- Along the walk, conversational interviews using an open-ended questionnaire can help address the important elements, dynamics and constraints in respect of the agricultural use of each zone (*Toolbox 2*)

DESIRED OUTPUTS

Produce a narrative document that includes:

- Fine-grained and detailed characterizations of each agro-ecological zone (plus illustrations such as the agro-ecological transect) (*Example 4 and Example 5*)
- Hypotheses about why different agro-ecological zones are exploited differently (or not), drawing on their biophysical constraints and opportunities
- The flow of resources within each and across agro-ecologic zones (manure, water, nutrients, and so on)
- The delimitation of the study area and the rationale for this choice

The document should use precise and specific vocabulary and leave no place for personal judgment. The vernacular terminology in the local language about places and elements of the agrarian landscape should be carefully documented and translated.

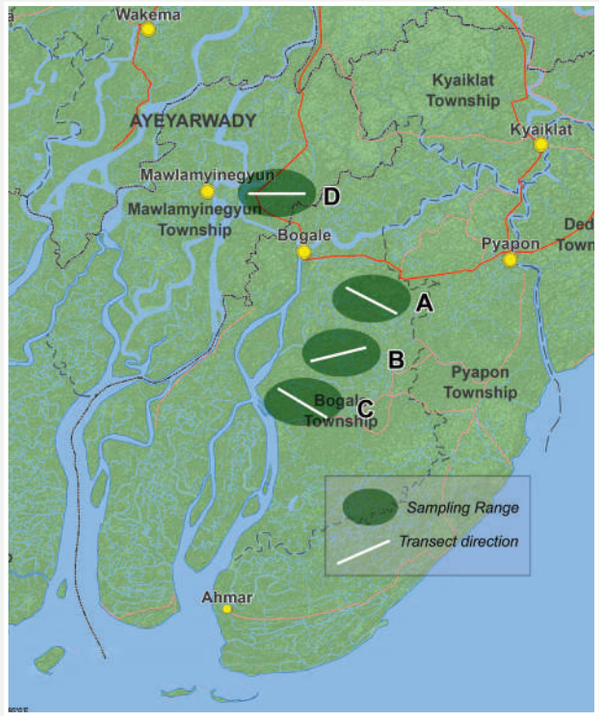


Example 4

A series of agro-ecological transects and block diagram

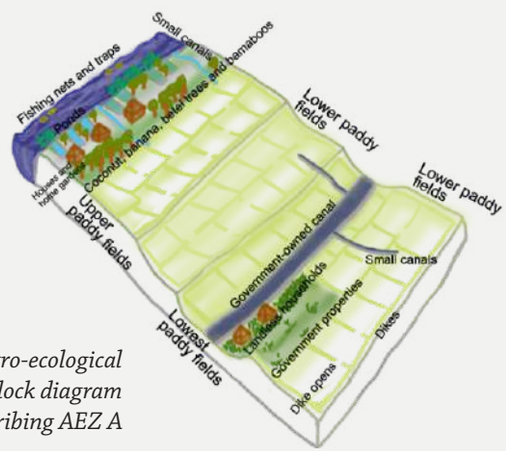
Ayeyarwady Delta, Bogale and Mawlamyinegyun Townships, Myanmar
Illustrations by Yi-Jen Lu, 2017

Selecting different transect walks: In the delta region, the agro-ecological conditions vary greatly according to the topography, pedology (type of soil, texture and colour) and intrusion of water salinity. Four different transect walks were selected based on these criteria (villages A, B, C and D).

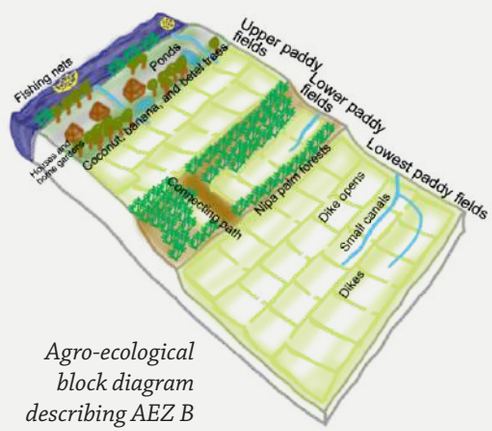


#	Agro-ecological areas
A	*Bogale freshwater area*
B	*Bogale brackish water area*
C	*Bogale saline water area*
D	*Mawlamyinegyun freshwater area*

In some cases, 3-D representation provides a better "visual" understanding of the landscape (e.g. especially when waterways are involved). It is also possible to illustrate the findings of the transect walks and field observations with block diagrams to describe each zone such as in the example below (AEZ A on the left and AEZ B on the right):



Agro-ecological block diagram describing AEZ A



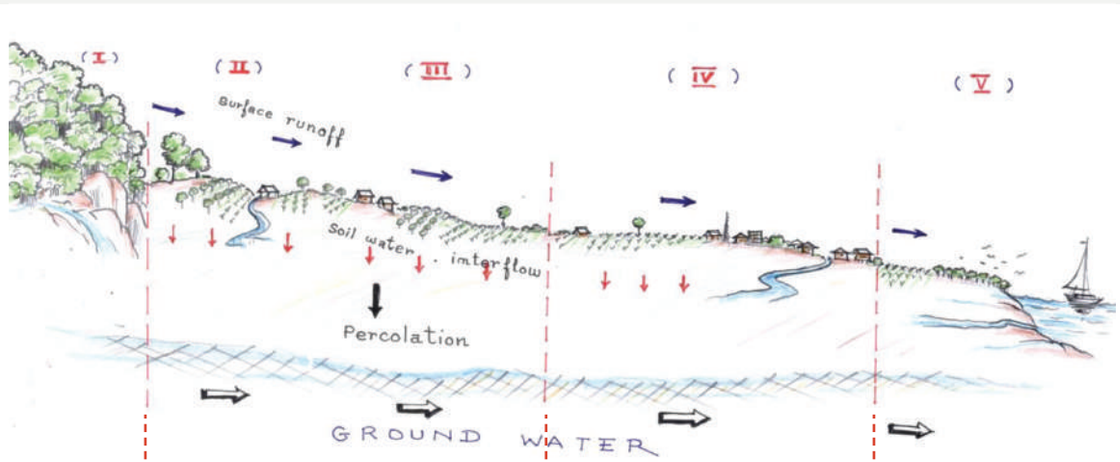
Agro-ecological block diagram describing AEZ B

1

Example 5
Agro-ecological transect

Battambang province, Cambodia
Illustration by BPSPWG 2009

It is also useful to document the transect walk in step with the criteria selected to describe each agro-ecological zone. This way, both sets of information can be combined to a gain a richer picture.



	AEZ 1	AEZ 2 and 3	AEZ 4	AEZ 5
Elevation	Moderate or steep inclines High: 1000–1250 m	Gently rolling highland with some lowland areas to rivers 250–1000 m	Mainly rain-fed lowland prone to flooding 15–50 m	Gently rolling low-lying land, entirely inundated for long period (5–15 m)
Water resources	Seasonal and perennial stream	Non flooded, perennial and season stream	Larger stream and river – occasional lake and ponds (perennial). Partly flooded	Seasonal flood, numerous lakes/ponds
Climate	High rainfall (>2000 mm/year) – 2 month dry	Rainfall: 1500–2000 mm/year Low drought risk, rains start east to west	Rainfall: 1000 - 1500 mm/year 3-month dry	Rainfall: 1000–1500 mm/ year 2-month dry
Geology	Sandstone Triassic	Quaternary colluviums (pediments) + limestone	Quaternary lake deposits	Quaternary organics deposit
Soils	High drainage, superficial, erodible, fragile Leptosols	Cambisols–leptosols–Nitisols	Luviols–Vertisols	Gleysols–Fluvisols
Land Use	Forest (timber extraction), hunting, charcoal, NTFP collection	Highland agriculture with fruit production and livestock Abandoned crops covered by grass or shrub Some lowland paddy in depressions	Main rice plain – settlement, main infrastructure Significant fruit tree farming system Limited area of irrigated farming	Flooded plain (flooded grassland, flooded shrub and forest) Capture-fish-based livelihood systems Migratory (seasonal) livestock systems Deep water rice

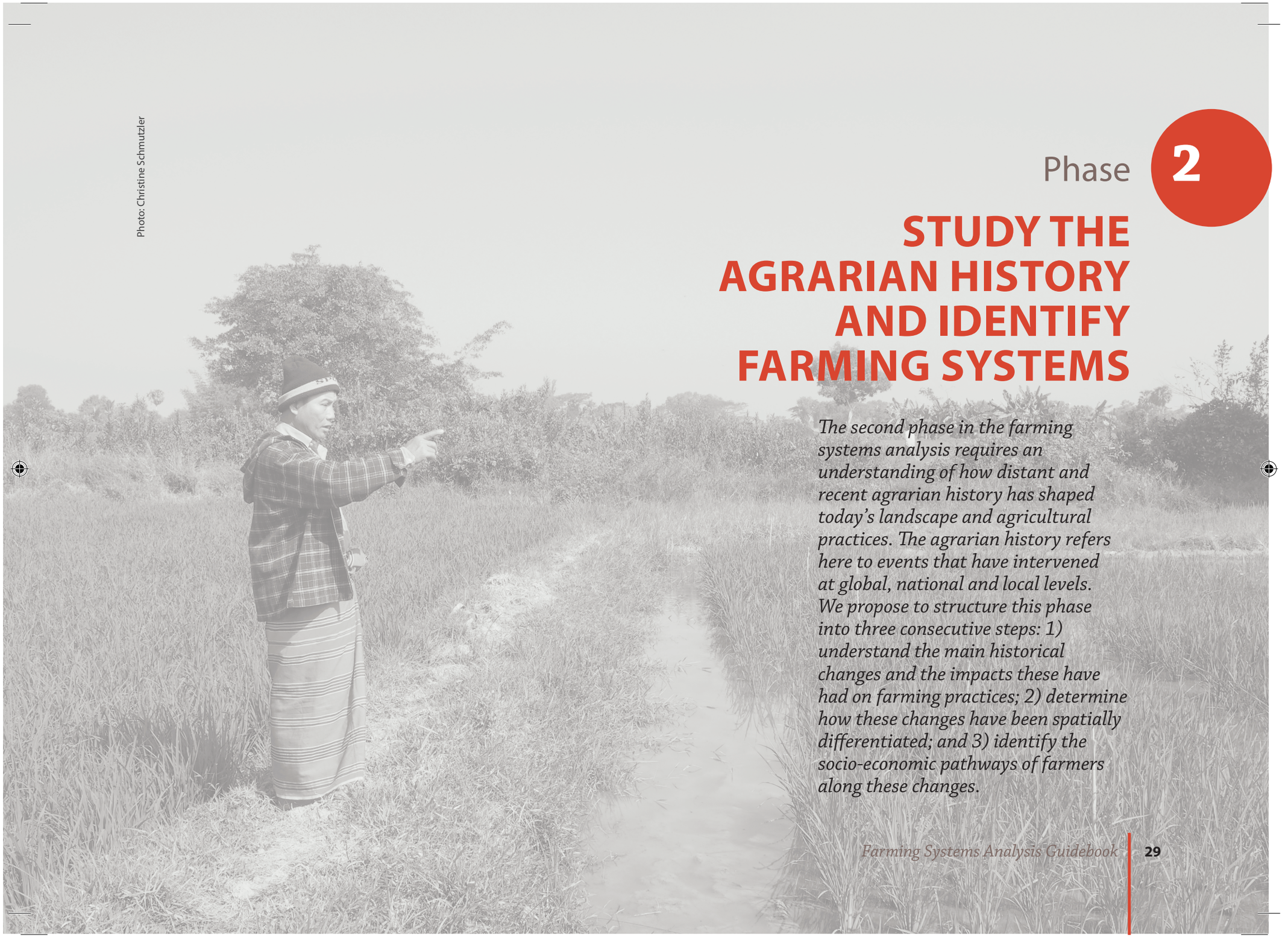


Photo: Christine Schmutzler

Phase 2

STUDY THE AGRARIAN HISTORY AND IDENTIFY FARMING SYSTEMS

The second phase in the farming systems analysis requires an understanding of how distant and recent agrarian history has shaped today's landscape and agricultural practices. The agrarian history refers here to events that have intervened at global, national and local levels. We propose to structure this phase into three consecutive steps: 1) understand the main historical changes and the impacts these have had on farming practices; 2) determine how these changes have been spatially differentiated; and 3) identify the socio-economic pathways of farmers along these changes.

2 STEP 2.1 UNDERSTAND HISTORICAL CHANGES

SCOPE AND CONTENT

An understanding of the agrarian history is essential in any farming systems analysis. The events of the agrarian history that have affected the landscape and the farming systems are at play at different levels — e.g. changes in the world commodity market or the raising of global interest in land, national policies that have had an impact on land and agriculture (such as policies aiming to promote specific crops), or more context-specific transformations in the study area (such as the occurrence of local conflicts and migrations or the construction of an irrigation scheme). It is difficult to fix the timeframe for this agrarian history review but the researcher should aim for a review of at least the last 50 years.

As a first step into the agrarian history, we propose to identify changes in the agrarian landscape. For each of these changes, we determine when they occurred, why, and the overall impacts they have had on the farming systems. The following themes should be addressed:

Farmland and cropping activities

- Changes in the type of crops cultivated in the area, e.g. the introduction of new crops, the decline and cessation of crops, the expansion/reduction of cropping areas, changes in crop varieties, changes in crop succession, changes in crop association, and so on
- Changes in the cropping calendar (be specific for each crop)
- Changes in the management of fertility, e.g. changes from manure to chemical fertilizer, salinization, salt intrusion, erosion, agro-forestry practices, and so on.

Tools and technologies in cropping systems

- Changes in the equipment used in cultivation: e.g. manual or mechanical equipment, provision of services by tiers for soil preparation, crop maintenance and/or harvest
- Changes in water management: e.g. irrigation schemes, pumping or drainage, and so on.

Livestock and animal rearing activities

- Changes in the type of livestock reared, e.g. new or now-extinct breeds, expansion/reduction of a particular type of livestock
- Changes in the purpose of animal husbandry activities (e.g. saving, draught, farrowing, breeding-fattening, farrowing-to-finish)
- Changes in animal feed (e.g. grazing, fodder)
- Changes in rearing techniques (e.g. shelter, veterinary care).

Common pool resources

- Changes in the stock/availability of fisheries and forest resources
- Changes in the management of fisheries and forest resources.

Other notable changes in livelihoods

- Employment opportunities in the agricultural sector or outside of agriculture (involving migration or not)
- Development of transport infrastructure (density and quality of the road network).

Through the same interviews, it is then important to examine the drivers that explain these changes. These drivers include, but are not limited to:

- Population change: demographic increase or decrease and the dynamics of in- and out-migration
- Land tenure policy: the mode of access and control of land that might affect the distribution of land among family farmers as well as the security of their tenure (e.g. establishment of cooperation, de-collectivization, establishment of protected areas, granting of land concessions, land titling, and so on)
- Development of infrastructure, e.g. for water management and transport
- Transformation in domestic and export markets for important commodities as input or output of cropping and livestock systems (e.g. prices, commodity chains, processing)
- Natural disasters: cyclones, droughts, floods, more subtle effects of climate change
- Political or social instability: e.g. military interventions, and so on
- Any particular development intervention by an NGO, a private sector entity, or the State, e.g. the introduction of new crops, seeds or breeds, a specific investment in land or in infrastructure, training offered to farmers, and so on.

2

METHODS

First of all, it is important to collect and examine the existing **literature on the agrarian history** of the country or the region in order to contextualize the history of the agrarian system and identify a chronology of key historical milestones that influenced the development of agriculture in the area studied. Key historical events can have a national scope (e.g. national policies) or might have occurred locally.

Key informant interviews with people and families living in the study area are a preferred approach to glean a clear picture of the local agrarian history. Interviews with the oldest farmers are particularly meaningful as they have witnessed changes over one or two generations. Interviews with young farmers are also meaningful to acquire a sense of how the young generation identifies with agriculture and how they see their future as farmers. Group discussions are invaluable in crafting consensual knowledge and collecting more information within a limited timeframe, while individual interviews create more privacy between the interviewers and interviewees thereby encouraging discussion about conflicts and other sensitive issues (*Annex 1*).

A preferred format is an open-ended interview that is not based on preconceived and deductive thinking by the interviewers but is more open to the world of the interviewees (*Toolbox 3*). During an open-ended interview, the investigator facilitates a discussion; he or she does not direct the discussion toward a particular end. It often starts with very general aspects and questions, and may gradually drill down to some specific questions. It is important to allow the interviewees to refer to their own meaning and knowledge about the events that have shaped agriculture and lives in their communities. It is also important to bear in mind that a discussion about the nature and the causes of historical changes usually results in the interviewees addressing events in a random or not pre-organized manner. Some time and effort will be needed after the interviews to reorder events into chronological order, and to possibly fine-tune the focus of the interviews during the process.

In practice, the work of the investigator will often alternate between key informant interviews and the reading of literature. A back-and-forth movement between "the field and the books" will be necessary to progressively cover the set of questions and issues and to unpack the complexity of links between cause and effect in the variety of technical, economic, political and social elements at play throughout the relevant history.

DESIRED OUTPUTS

- As a result of this series of interviews, the researcher will come up with a periodization of the agrarian history that is meaningful to the local communities. It is important to note that this periodization is not necessarily similar to the standard historical phasing that may be used in textbooks or as explained by NGO workers or extension officers. It might be useful in certain cases to present a timeline of the history of the agrarian system with reference to national level transformations in policies and mode of production, along with more context-specific descriptions of how changes occurred in the study area (*Example 6*)

- Each period needs to be characterized by the prevailing agricultural and land policies, the mode of organization of agriculture that unfolded and the influence/consequences this had on land use patterns, cropping and livestock systems, through transformations in labour, tools and agricultural technologies. It might also include other notable changes that have influenced livelihoods in the study area. It is equally important to understand the nature and the process of transition between periods so as to capture how changes have emerged.

Toolbox 3—How to conduct a key informant interview about the agrarian history?

1. Consult several people who will help you select your key informants – people who are knowledgeable about the agrarian history (retired authorities and elders).

2. Identify the discussion topics about which you need clarity. The questions should be such that interviewees can express opinions through a discussion/dialogue.

3. A logical sequence of questions should help the discussion to flow.

4. For each discussion topic, prepare an interview guideline.

5. When you start the interview with the key informants, introduce yourself and explain the purpose of the interview. Be sure the informant understands the purpose of the interview and what you intend to do with the information you will receive from him/her. Emphasize the fact that the interview results will remain confidential.

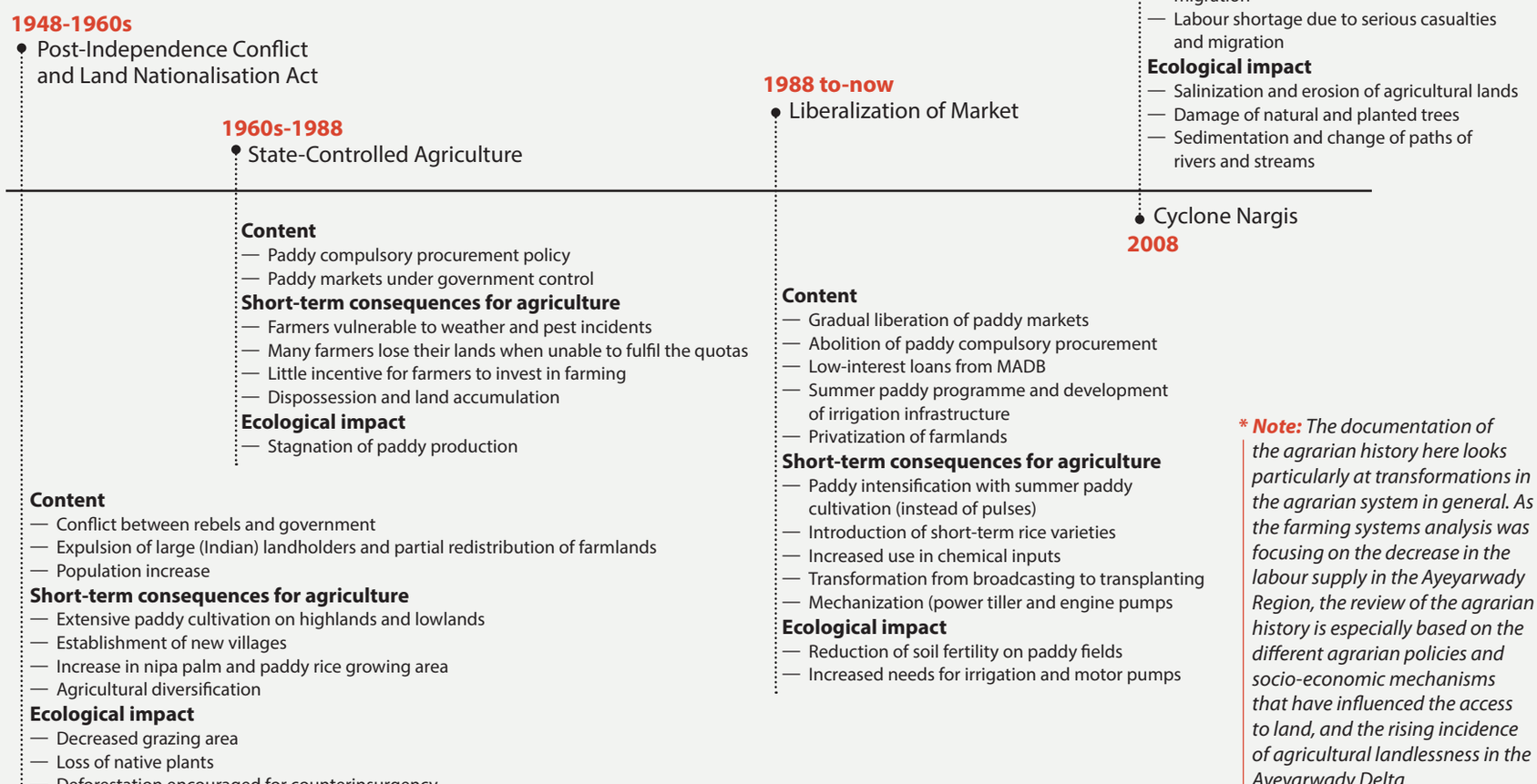
6. A good interviewer will have the following abilities:

- Neutrality and the ability to listen (to avoid sharing his/her own views on the subject)
- Familiarity with the issue discussed (to be able to ask additional, unanticipated questions if required)
- To seek clarification and elaboration in respect of initial responses, while maintaining a conversational tone (to avoid making the informant feel interrogated, judged or misunderstood).

2

Example 6—Important historical milestones and consequences on the agrarian landscape*

Bogale and Mawlamyinegyun Townships, Ayeyarwady Delta, Myanmar
Adapted from Yi-Jen Lu, 2017



* ***Note:*** *The documentation of the agrarian history here looks particularly at transformations in the agrarian system in general. As the farming systems analysis was focusing on the decrease in the labour supply in the Ayeyarwady Region, the review of the agrarian history is especially based on the different agrarian policies and socio-economic mechanisms that have influenced the access to land, and the rising incidence of agricultural landlessness in the Ayeyarwady Delta*

STEP 2.2
EXAMINE AGRARIAN TRANSFORMATIONS AT LANDSCAPE LEVEL

2

SCOPE AND CONTENT

A working hypothesis that guides the farming systems analysis is that historical changes have not occurred or affected the different agro-ecological zones in the same way. In other words, the relative exposition of different agro-ecological zones has resulted in different impacts and in a process of spatial differentiation. Clearly, this question as to where the changes have occurred should be addressed in close relationship with the agro-ecological zoning conducted earlier. The investigation should be guided by the following questions:

- Where have the agrarian changes described earlier occurred?
- Where have they had a relatively greater or lesser impact?
- What have been the positive short-term and long-term impacts of these changes? Explain
- What have been the negative short-term and long-term impacts of these changes? Explain.

METHODS

This step is still very much based on key informant interviews (individual or group), so the topic will unfold naturally from the previous discussion. However, the focus of the discussion is somewhat more specific and spatially explicit. It is, therefore, helpful to use the agro-ecological transect and zonation map produced earlier: this will facilitate the discussion for both interviewers and interviewees enabling them to identify the different pathways of evolution of the different agro-ecological zones *(Annex 1)*.
In addition, it is useful to triangulate the information and knowledge generated from village discussions with secondary sources of information. The recourse to Google Earth is useful here to identify what and where changes have occurred in the landscape. Meaningful information to support an easy land cover and land use change analysis could be acquired through Google Earth without knowledge about GIS. Likewise, the use of historical maps and references will give a sense of what the landscape looked like in the past.

DESIRED OUTPUTS

This part of the investigation can be illustrated and documented using a variety of visuals such as:

- Time-series transects showing the evolution of land cover and land use in specific areas of the agrarian landscape (*Example 7*)
- Time-series agro-ecological diagrams showing the spatial differentiation across the agro-ecological zonation established earlier

If the researcher has opted for a more GIS-assisted technology, a spatially explicit land cover and land use analysis could be performed not only to locate but also to quantify land use changes that are detectable on the landscape.

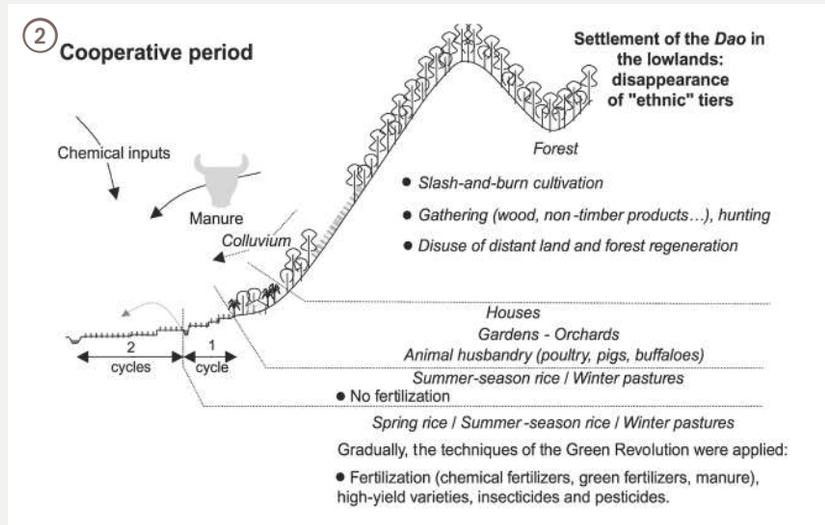
2

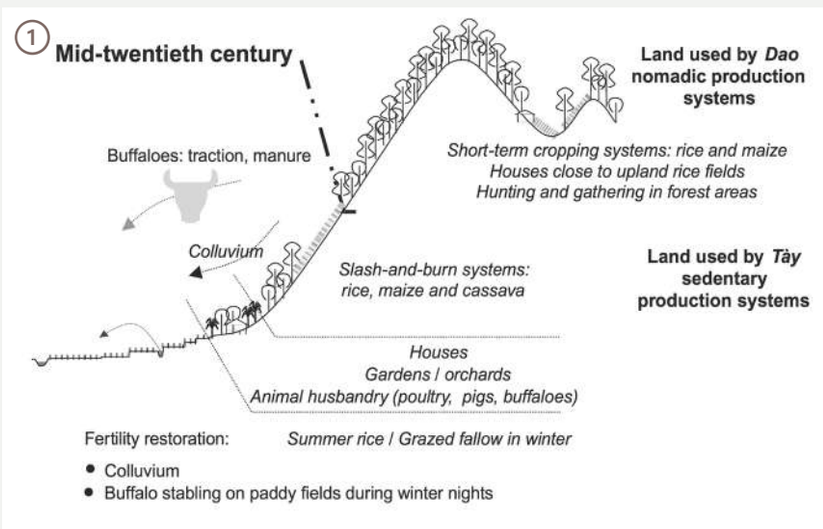
Example 7

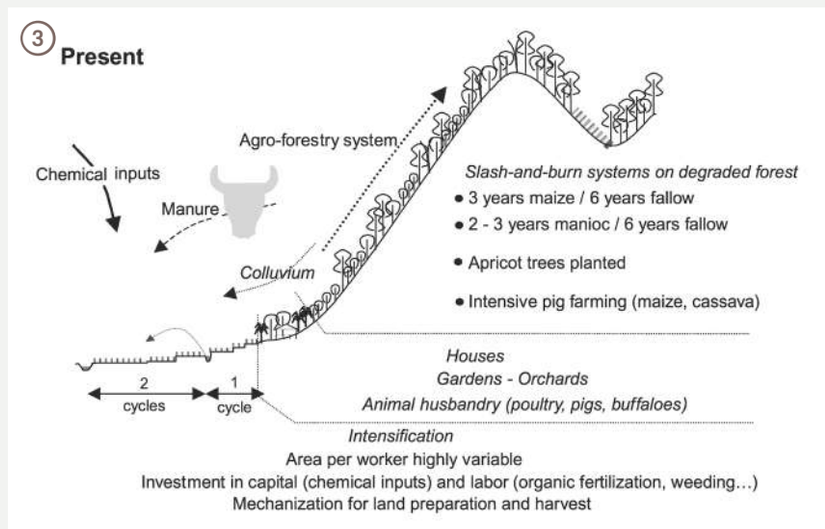
Dynamic of land use changes

Xuat Hoa Commune, Bac Kan Province, Viet Nam
Illustration by Sadoulet et al., 2002

These time series illustrations represent the main elements of an agrarian landscape for different periods in the recent history of the region. They clearly illustrate the land use changes that have intervened along a particular transect as a result of the different agrarian policies promulgated by the Vietnamese government.







STEP 2.3
ANALYZE DIFFERENTIATION PROCESSES BETWEEN FAMILY FARMING SYSTEMS

2

SCOPE AND CONTENT

Another important working hypothesis that guides the farming systems analysis suggests that farmers have not been influenced in the same way by the agrarian transformations described earlier. As a result, they have followed different evolution pathways, which are visible today in the structure of the farming system, e.g. the size of landholding, capital endowment or the particular technical choices made by the farmers or differing degrees of access to other income generating activities. The production of these differences, visible in the technical aspects of the farming system or in the socio-economic status of the family, is what we call "differentiation". The understanding of the differentiation processes - how these differences have emerged and have been reinforced — is central to the farming systems analysis.

The farming systems typology is a classification of farming systems that makes sense of these differentiation processes and of the current diversity of farming practices. The typology aims to classify families into a limited number of relatively homogeneous and contrasted categories so as to understand the dynamics and functioning of the farms in each category, as well as to compare and explain their differences.

A farming systems typology is based on 1) the historical trajectories of the family as they relate to the agrarian history, 2) the characteristics of the farming system which depend on the agro-ecological environment in which the farming system operates and the choices made by the family farms.

The farming systems typology is based on the research question that frames the analysis. If the objective is to understand the evolution of the farming techniques, and it aims to identify recommendations to improve farming activities, the typology will principally examine the farming activities. In turn, if the objective is to examine the different trajectories of a wider range of families into or away from agriculture, the typology will be based on activity systems rather than limited to farming activities[2].

We propose to build the farming systems typology by taking into account two intertwined elements: the **size of operations** (the access to, and distribution of farming factors of production) and the **technical choices** (the diversity of current farming practices and other activities).

The identification of the different "categories of farmers" based on the size of their operation (endowment of land, capital, labour, and so on) is an important prerequisite before examining the farming systems. This requires an understanding of the historical circumstances, which explain why certain farmers are now endowed with relatively larger/smaller landholdings, livestock size, value of capital, and so on. In this discussion, the categories of "landless household" deserve particular attention. In addition to understanding their current income-generating activities, use

2 Given the agrarian context in which the farming systems analysis is deployed, the approach we recommend for the typology is to start with understanding the differentiation of the farming activities *per se*, even if it is marginal in the income generation portfolio. We then propose to qualify and then integrate off-farm and non-farm activities in a systemic way: that is, to understand the role they play in their interaction with farming activities, how they complement the farming income and labour occupation. This approach also contributes to a better understanding of the progressive and uneven transformation of the economy from predominantly rural and farm-based to increasingly urban, service-based and oriented to industrial production.

2

of common pool resources, off-farm and non-farm activities, it is important to identify why they are landless. Furthermore, it is pertinent to ascertain if they have never had land, or if they did have land but not anymore, whether this results from a deliberate choice or from a constrained/distress sale. Understanding the exclusion process that has divorced households from land-based activities is particularly important in formulating recommendations to support the most vulnerable families.

Once the factors of differentiation in accessing the factors of production are elicited (the question of **size of operations**), it is important consider the diversity of farming, non-farm and off-farm activities (the question of **technical choices**), that are combined within each farming system. These choices are partly free and can thus be seen as decisions freely made by the household. But they are also constrained by wider political, economic and social constraints that limit the possible options of the moment (*Cochet 2015*). What is key here is to understand how various cropping and livestock activities are combined with other activities, and the decision-making mechanisms presiding over these choices. The choices made by farmers also depend on the opportunities and constraints of their agro-ecological environment. They also depend on the interests and objectives of the farmers that are shaped by intergenerational dynamics.

METHODS

The establishment of the typology is principally based on discussions conducted in previous steps (*Annex 1*) and *ad hoc* interviews to clarify certain differentiation mechanisms (*Toolbox 4*). Within agrarian landscapes, the possible "trajectories" of farming systems are limited. Experience indicates that a typology should consist of a sufficient number of "types" (i.e. five to seven). If too many farming system types are identified, the complexity of the typology makes it difficult to conduct meaningful analysis and if it is too limited, the differences between types cannot be clearly identified (*Cochet 2015*).

The farming systems typology can be established using many criteria (not only type of crops and land size). As in the case of the agro-ecological zoning, it is important to realize the exercise in the context of the specific and real-life development issues that frame the farming systems analysis (see below the example of a farming systems typology framed by questions relating to land access in a context of forest pioneer fuelled by migration).

It is important to keep in mind that the typology may still be fine-tuned as you proceed with phases 3 and 4.

DESIRED OUTPUTS

- The ideal output in this step is to draw a dynamic typology of farming/activity systems that pictures the chronology of important events of the agrarian history and, through the same time line, identifies the different evolution pathways of farming/activity systems. These pathways should ideally explain the differentiation processes in the access to factors of production as well as the diversity of farming, off-farm and non-farming activities of the family *(Example 8)*.

Toolbox 4—How to construct a farming system typology?

- Discuss with stakeholders how the specific research question and objectives guiding the farming systems analysis can be integrated within the general approach of the typology (e.g. based on the historical trajectories of households and the agro-ecological diversity of the milieu).

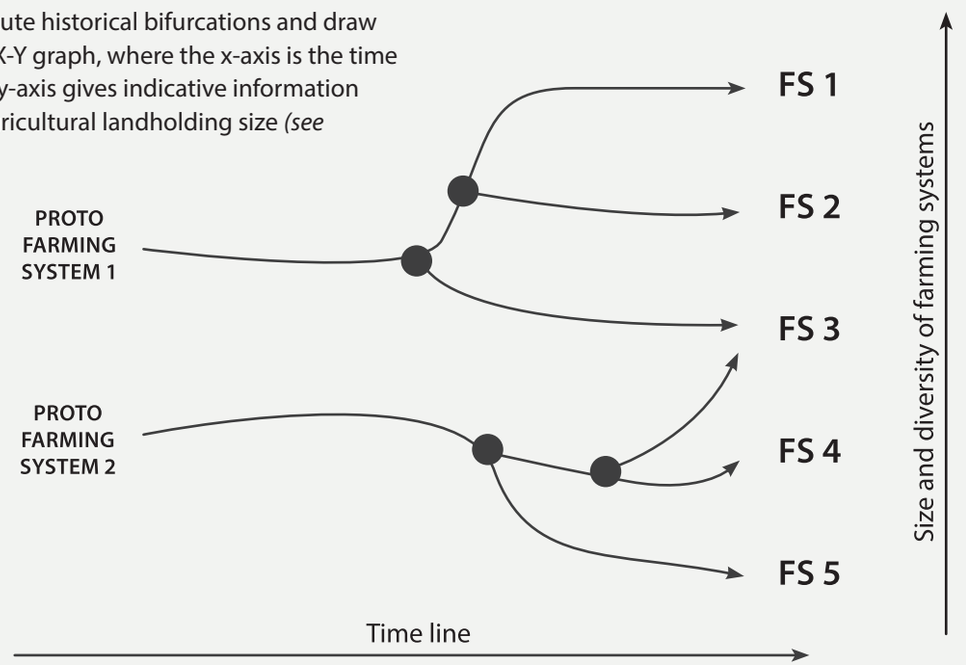
- Through unstructured, open-ended conversational interviews, identify the current diversity of farming/activity systems. If the focus of the typology is on farming activities, the key is to identify different classes of landholding size as well as the nature, relative importance and specific combination of cropping and livestock systems. If the focus of the typology is rather on the activity system, the key is to identify the nature, the relative importance and specific combination of farming, livestock, common pool resources (CPR), agricultural wage labour (off-farm) and non-farm activities and how they are integrated by the household.

- Understand what elements of the recent or distant history (policy, demographic change, change in land (re)distribution), and of the agro-ecological context explain the current structure and function of farming/activity systems. To conduct this identification, there is no need to build a unique set of variables, carefully organized in a pre-established standard questionnaire and groups based on specific threshold values. This identification can proceed with open-ended interviews (purposive sampling).

- Reconstitute historical bifurcations and draw them on an X-Y graph, where the x-axis is the time line and the y-axis gives indicative information about the agricultural landholding size *(see below)*.

- Once a preliminary typology is defined, select a couple of households representing each type (through purposive sampling), and ask them questions to better understand the system.

- At the end of the process, it is useful to validate the typology with villagers to make sure that the differentiation processes and the farming system types that have been identified make sense to them.



Proto Farming System 1 to 2:
Farming Systems existing decades ago

● Point of bifurcation in the differentiation process, for instance due to agrarian expansion, mechanization, access to irrigation, land loss through market (relevant to the research question).

FS1 to FS5: Current diversity of farming systems (depending on size and characteristics of cropping and livestock system)

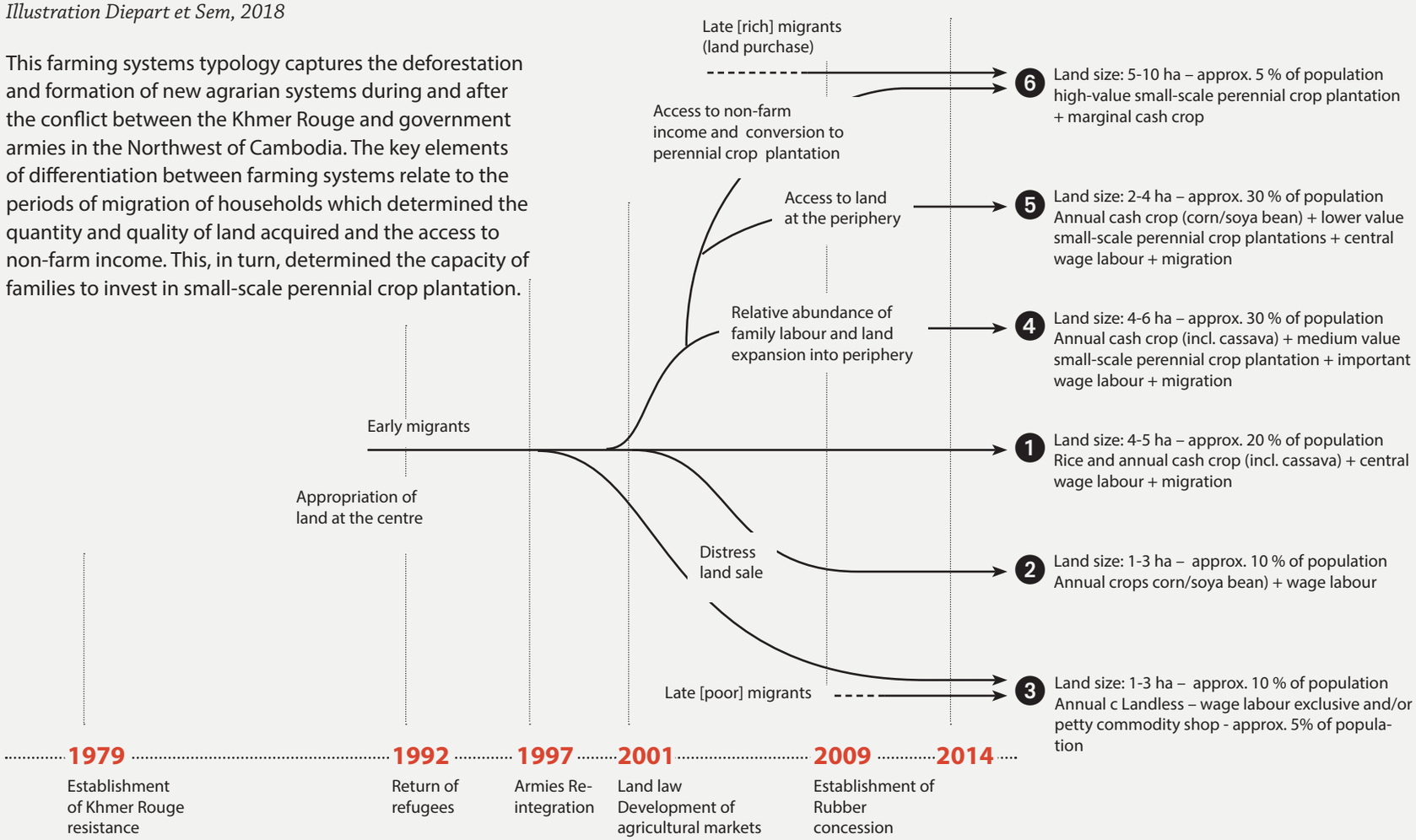
2

Example 8

Farming systems typology

Samlaut district Battambang, Cambodia
Illustration Diepart et Sem, 2018

This farming systems typology captures the deforestation and formation of new agrarian systems during and after the conflict between the Khmer Rouge and government armies in the Northwest of Cambodia. The key elements of differentiation between farming systems relate to the periods of migration of households which determined the quantity and quality of land acquired and the access to non-farm income. This, in turn, determined the capacity of families to invest in small-scale perennial crop plantation.



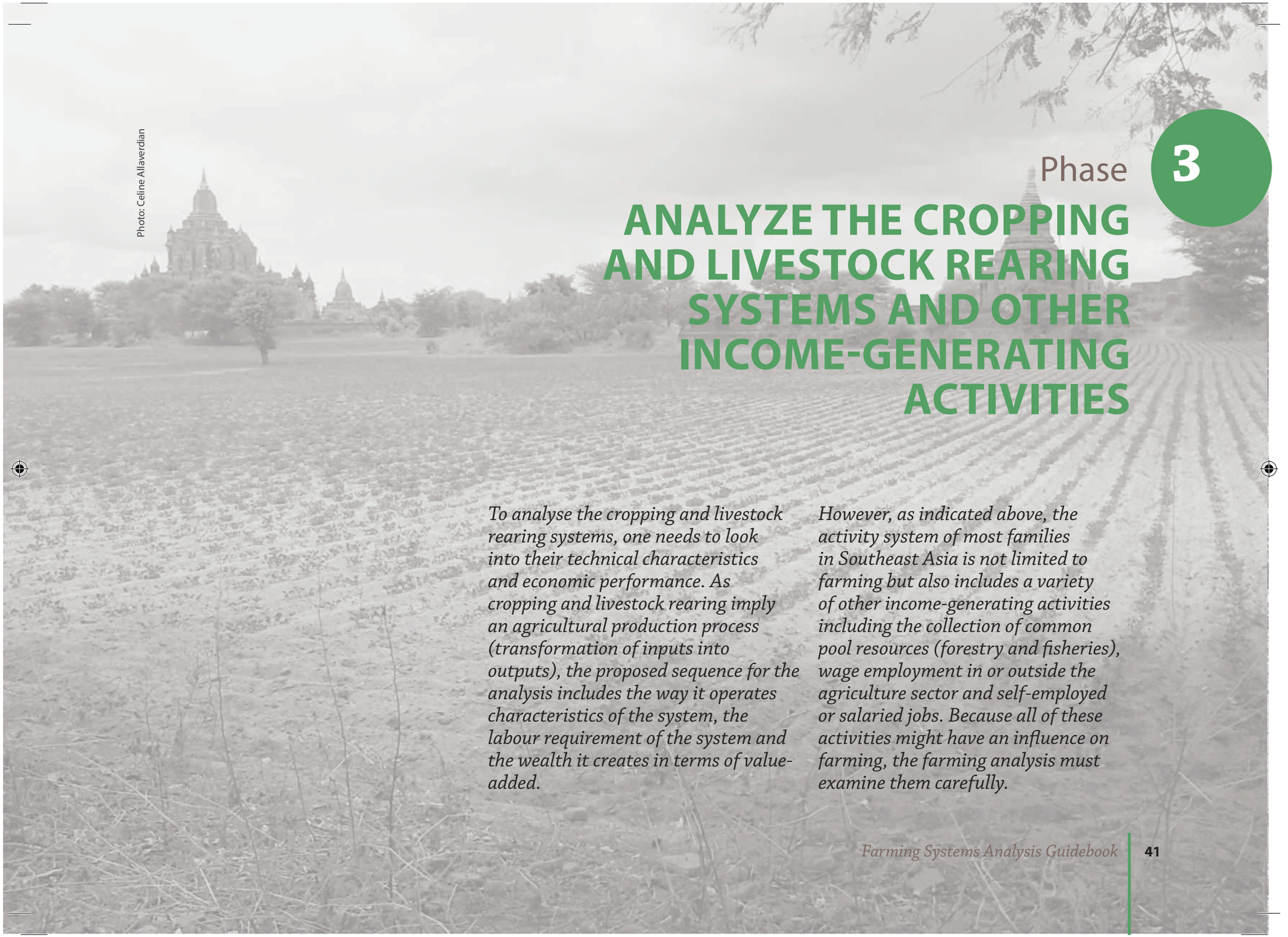


Photo: Celine Allaverdian

Phase 3

ANALYZE THE CROPPING AND LIVESTOCK REARING SYSTEMS AND OTHER INCOME-GENERATING ACTIVITIES

To analyse the cropping and livestock rearing systems, one needs to look into their technical characteristics and economic performance. As cropping and livestock rearing imply an agricultural production process (transformation of inputs into outputs), the proposed sequence for the analysis includes the way it operates characteristics of the system, the labour requirement of the system and the wealth it creates in terms of value-added.

However, as indicated above, the activity system of most families in Southeast Asia is not limited to farming but also includes a variety of other income-generating activities including the collection of common pool resources (forestry and fisheries), wage employment in or outside the agriculture sector and self-employed or salaried jobs. Because all of these activities might have an influence on farming, the farming analysis must examine them carefully.

3

STEP 3.1
ANALYZE THE CROPPING SYSTEMS: TECHNICAL ITINERARY AND ECONOMIC PERFORMANCE

SCOPE AND CONTENT

As mentioned earlier, a cropping system is defined for all of the plots that are cropped in the same way in a given agro-ecological zone. It refers to a specific combination (in space and time) of crops and the cropping practices used to grow them *(Sebillote, 1976)*. To describe the whole diversity of cropping systems, the following aspects must be examined: the characteristics of the cropping system; the farming practices and labour requirements; the economic performance of the system; and its technical limitations.

Characteristics of the cropping system

To describe the cropping system, it is important to identify the main crops (single crop or mixed crops) and varieties cultivated. It is also important to understand the criteria farmers use to decide which crops and varieties to plant.

Other elements that are essential to characterize cropping systems are:

- The **crop layout** refers to the characteristics of the plots and location of these cropping systems within the landscape in relation to the topography, access to water, soil quality, distance to farmers' homes, to roads and towns, and so on (to be linked to the landscape analysis conducted previously which identified specific agro-ecological zones)
- The **crop sequence** refers to a particular succession of crops on one or several plots
- **Crop association and rotation**. It is also important to know if there are particular crop associations (several crops grown simultaneously on the same plot) or crop rotation (different crops one after another on the same plot, with or without fallow periods, over several years).

In the case of crop association, it is necessary to understand how the crops are associated in time and space and why farmers associate these crops on the same plots: what is the effect of the previous crop on the soil quality (crop residues, presence of weeds, pests and diseases)?
It is possible to combine the crop layout and the crop rotation to have an overview of how a farm manages different plots in time and space. However, given all the complexities of the cropping system, it is important to describe them using some key conventions (*Toolbox 5*).

Toolbox 5
How to describe crop sequence and rotation?

Separate the annual cycle with two slashes **- //**
For a sequence within the same year, separate each crop cycle with one slash **- /**
For crop association within the same cycle, put a **+**.
Example: Pigeon Pea **+** Sesame **//** Sesame **/** Lima bean **//** Fallow 2.
This means that pigeon pea is mixed with sesame in year one, then in year two, sesame is grown in a first crop cycle, followed by a second crop cycle with lima bean. This is followed by two years of fallow (in year three and four).

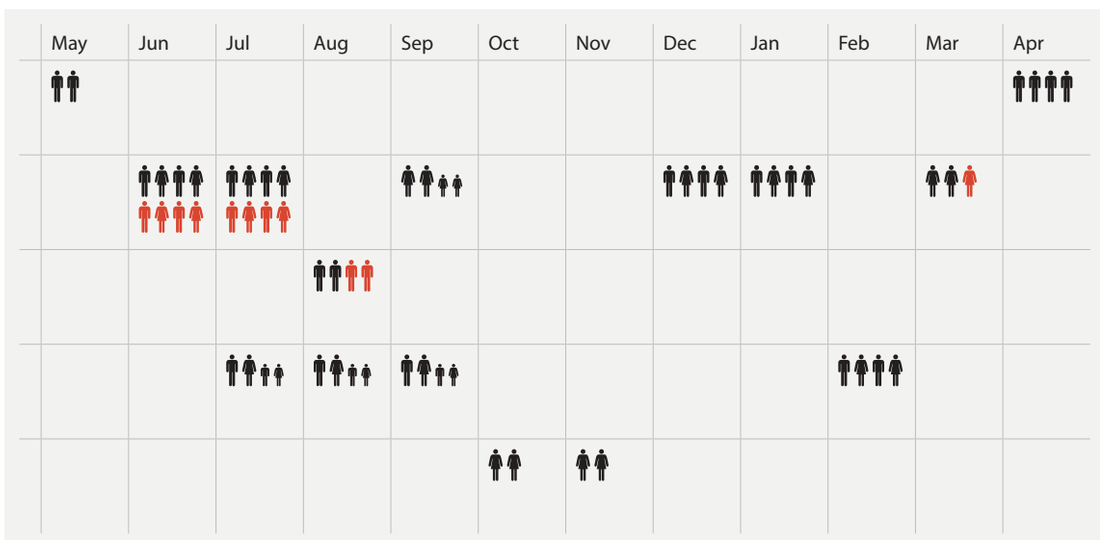
The farming practices and labour requirements

For every crop of each cropping system, it is important to understand the crop management sequence. This refers to the step-by-step logical and organized sequence of activities conducted on the plot from land preparation to the sale of the products. The crop management sequence is different from one cropping system to another. For each cropping operation, you will need to ask:

1. When it is performed?
2. Why? What are the main effects?
3. How? With what tools and inputs?
4. What are the labour requirements?

To answer these questions, it is necessary to produce a cropping calendar that pictures the sequence of the different cropping operations conducted from soil preparation to harvest.

Progressively, you will understand how the farmer mobilizes the workforce and all the necessary inputs and costs. It is recommended that these operations are differentiated based on the age and gender (adult/child, male/female) and status of the workforce (family labour/hired labour/ exchange group) (*Toolbox 6*).



3

Toolbox 6—How to evaluate the labour requirements and labour constraints in the cropping systems?

Once the researcher has clearly defined the technical itinerary and the detailed sequence of operations from land preparation to the sale of the product, it is necessary to evaluate the quantity of labour or working time required for each task. This working time is measured in working days (also called "men-days"): one man-day is the amount of labour that one worker can carry out in a day – generally composed of seven to eight hours. In order to evaluate the total number of men-days, two questions should be asked during interviews:

1. How many people are conducting each task?
2. How many days does each of these people work to complete the task?

The total number of men-days is the sum of days worked by each and every person involved in each task of the production process. For example, if three people are involved and are working respectively eight, seven and five days, the total amount of labour in men-days will be 20. In order to standardize the information for comparison, express the figures in **men-days per acre (or hectare) and per year**.

It is important to differentiate between the number of men-days provided by the family members and the number of men-days provided by external labour, paid either by cash or as part of a non-monetized labour exchange group.

Identifying labour constraints

You also need to know when each task is carried out as specifically as possible. It is also important to ascertain whether the timing of a given task is flexible (or not), and, if so, within what timespan. If not, the reasons and consequences should be determined. The cropping calendar will also help identify the labour peaks. This refers to the periods during which labour requirements are maximal. From these labour peaks, one can calculate the area of land that can be cultivated by one family according to the number of on-farm workers available.

Organization and division of labour

In addition, it is important to understand how the work is organized and how the tasks are divided between the different workers. For example, men often undertake very physical tasks such as land preparation while women are often mobilized for weeding and harvesting. Children tend to be involved in keeping livestock. This information is useful in indicating whether or not some tasks can be done by other family members in order to achieve a better understanding of labour constraints. Are on-farm workers hired to work? If yes, of which sex? For which tasks? Under what arrangements? Do farmers face difficulties in finding labour? If yes, at what periods? How do they manage the labour shortages?

Are there labour exchanges? Are there reciprocal and balanced labour exchanges (such as a self-help group of a limited number of people, through which all members work together for each family in turn and contribute the same amount of work to each other) for certain tasks?

Fertility management practices

Maintaining soil fertility is crucial to ensure the sustainability of the cropping systems. It is thus necessary to assess its variations through time (stable or decreasing) and to understand farmers' practices in this respect. How do they fertilize their fields? What types of chemicals and/or organic fertilizers do they use? In what quantities? When? What are the crop rotation and fallowing practices? Is there fertility transfer from livestock? If yes, how? How are crop residues being used on the field - burned, ploughed-in as green manure, grazed by cattle? Is fertility improved through regular alluvial deposits from floods?

The technical limitations of the system

An inquiry into the limitations of the cropping system is also useful. These constraints might be related to a problem of access to factors of production (land, labour, water, capital), technical issues encountered (soil quality, seeds and use of other inputs), uncontrolled post-harvest losses or commercialization issues. A discussion with the farmers should also examine how farmers deal with these limitations and the success they have in addressing them.

The performance of the cropping system

The measurement of the performance of the cropping system is based on notions of value-added and productivity. The value-added indicates the wealth created on a given cropping system during the production process. The notion of value-added is relevant because it allows for a comparison to be made between cropping systems.

The Gross Value-Added (GVA) equals the value of the gross product (production self-consumed, sold, given or lost in post-harvest) minus the value of all Intermediate Inputs (II) used during the production cycle. It measures the wealth created by the farming family and the people working with them. For this reason, the wages paid to external workers, the land rent if a farmer leases it, the taxes paid to the State and the interest rate paid to credit institutions should not be counted as Intermediate Inputs because they rather determine how the wealth is distributed, not how much wealth is created.

The calculation of the economic performance of a given cropping system (*Toolbox 7*) needs to take into account the fact that cultivation might occur in association (several crops on the same plot at the same time), in a succession (different crops on the same plot but in different seasons) and/or in rotation (different crops cultivated from one year to another). While it is important to capture this diversity, it is also essential to be able to compare performance between different cropping systems. It is the reason why all measures of Gross Value-Added are calculated based on the same unit, namely value–added per year and per acre (or hectare).

3

Toolbox 7—How to evaluate the performance of a cropping system?

Step 1
Identify crops and by-products of the cropping system

In consultation with the farmers, list all the crops and by-products that are obtained from each cropping system. For each crop, specify the area size that is cultivated and harvested and whether the main crops and their by-products are used for home consumption, on-farm consumption (e.g. livestock feed, seeds to use for the following season, sale, in-kind payment for labour, or for rent or sharecropping arrangements, and so on), as a gift or are simply lost during post-harvest processes (such as transport, threshing, drying, and the storage of crops).

Step 2
Estimate yields

It is convenient to estimate yields (production/ha) based on the average harvest with the local area measurement unit. It is also good to enquire about yields in "bad" and "good" years, the frequency of bad harvests and their main causes over the last 10 years. Keep in mind that higher yields are not always the farmers' main objective. They may prefer to maximize the production over a whole year (through crop associations and more crop cycles with lower yields), or maximize the diversity of crops or the productivity of their labour if they have a large agricultural landholding.

Step 3
Estimate the value of products

Then, the researcher need to estimate the value of the main crop harvested and all by-products. For this, one needs to proceed in different ways according to the use of the crop and by-products:

- For home consumption, on-farm production or for production given as a gift, the researcher estimates the value of the crop based on the purchase price if the family had to buy it (e.g. from the nearest market). It also includes the product that is given to others as a gift or as a contribution in respect of ceremonies.

- For product lost during the post-production processes, the researcher similarly estimates the value of the crop based on its purchase price (if the family had to buy it).

- For sale, the researcher estimates the value based on the farmers' average selling price (called "farm-gate price") at the time of the sale. This might be tricky because farmers might have different marketing strategies (some need to sell directly at harvest time while others store the produce for sale later at a higher price). It is important to understand these strategies in order to define the relevant price.

Step 4
Calculate the Gross Product (GP)

The Gross Product (GP) of a cropping system is the monetary value of the total annual production obtained from this cropping system, whether it is destined for sale, self-consumption, as a gift or is lost (as detailed above). The Gross Product is, therefore, the sum of the annual quantity of each product and sub-products multiplied by the unit price for each main crop and crop by-products.

Gross Product (GP) =

$$\sum_{i=1}^{n} Total\ product_i \times unit\ price_i$$

where n is the total number of individual crops and by-products harvested. The Gross Product should be expressed per acre (or hectare) and per year. In case of multi-annual rotation, the Gross Product is the average annual Gross Product, which is the total Gross Product of all crops / number of plots / number of years in the rotation.

Step 5
Calculate Intermediate Inputs (II)

The Intermediate Inputs (II) relate to the value of all the different inputs such as goods (e.g. seeds, fertilizer, pesticides, hormones, gasoline, and so on) and services (e.g. the renting of farm equipment, and tree grafting services) that are used during the annual production cycle

Intermediate Inputs (II) =

$$\sum_{i=1}^{n} Total\ product_i \times unit\ price_i$$

where n is the total number of inputs used. It is recommended to include the costs of all crops in association or in succession and measure the Intermediate Inputs per acre (or hectare) and per year. If the researcher measures the Intermediate Inputs for a crop rotation, keep in mind that this relates to the average annual Intermediate Inputs (=total II of all crops / number of plots / number of years in the rotation).

Step 6
Calculating Gross Value-Added (GVA)

The Gross Value-Added (GVA) is the Gross Product (GP) deducted from all Intermediate Inputs (II) *(GVA = GP – II)*. It is still a gross value as it does not integrate the depreciation of farm equipment (to be calculated at farming system level only) (*Figure 7*).

- In the case of crop association or succession, the Gross Value-Added of the cropping system is the sum of all Gross Value-Added calculated for the different crops on 1 acre (or 1 hectare) of land throughout the year.
- In the case of crop rotation (on one or several plots), the Gross Value-Added of the cropping system is the sum of the annual Gross Value-Added divided by the number of plots and the number of years in the rotation (expressed per acre or per hectare).

In subsequent analyses such as the calculation of Net Value-Added and farming income, one single value of Gross Value-Added will be used for each cropping system. This single values are simply the average, minimum and maximum of GVA obtained for the different farms that are part of the sample. It is thus important to check that results computed from each interview are plausible and realistic.

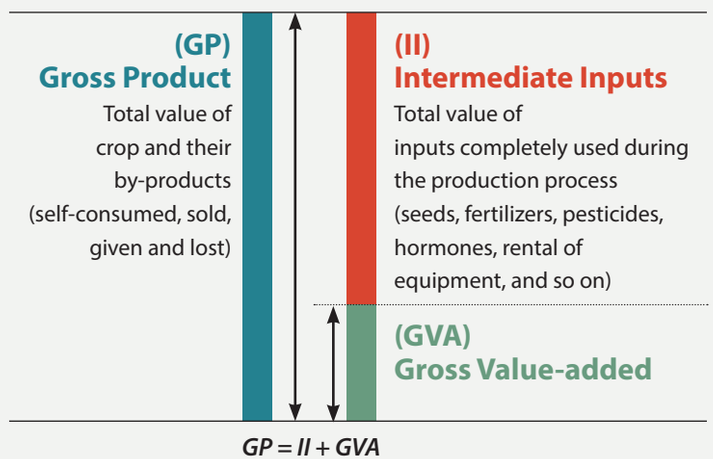


Figure 7—*Breakdown of the Gross Product into Intermediate Inputs and Gross Value-Added (Adapted from Cochet, 2015)*

3

Step 7
Measure the cropping system efficiency with land and labour productivities

In order to assess the efficiency and compare the results from one group of farms to another and from one region to another, information about land and labour productivity is essential. Both measures of productivity provide different information but both are based on the Gross Value-Added.

Land productivity measures the amount of wealth created per year on the area of land cultivated. It enables the measurement of how intensively and effectively the land is being used. As such, it is an expression of the productive process intensification. It is measured in GVA per unit area and per year (GVA/ha/year). This indicator is particular relevant in areas where access to land is limited, and where farmers try to "make the best" out of a limited land area.

Labour productivity measures the efficiency of the labour incorporated into the productive process. It measures the amount of wealth created based on the quantity of work put into the system. However, there are several ways of measuring labour productivity, whether the quantity of labour is expressed per active labourer, or per number of men-days. In the agricultural sector, where work is most often seasonal, the different measures to labour productivity offer different and complementary information. Although it is possible to calculate these indicators for a specific crop, it is much more relevant to do this for the overall cropping system as, for example, it provides a better understanding of farmers' decision-making processes over the whole year.

- Value-added measured for an agricultural active labourer and per year, measures the economic efficiency of an active labourer in a given production system.
- Value-added per man-day introduces a much more fine-grained measure of labour productivity that accounts for the productivity of days incorporated within the production process. The **total labour productivity** gives an indication of the productivity of all the labour incorporated in the productive process. It is expressed as the GVA per total number of men-days (family and external labour) and per year.
- The **gross remuneration of the family labour** [GVA–wages paid to external workers)/men-days/year] carried out by family members measures the gross margin that the farming family gets from one day of family labour spent on that cropping system. It is a highly relevant indicator as it allows for a comparison to be made with the income that could otherwise be obtained if the labour was dedicated to activities outside of farming.

METHODS

This part of the farming systems analysis does not have to be based on a statistically representative sample of farmers but should rather use purposive sampling. Cases that are considered to be rare but that shed light on particular dynamics are important to consider. Although all farming systems are considered to be dynamic, the selection of more "stable" farms is also recommended. The households that are currently under a major transition phase (e.g. following a major accident, or when the household is about to move out) should not be considered.

The detailed investigation of the cropping system should be conducted with 5 to 10 households of each of the farming systems identified in previous phase (*Step 2.3*). Given the large amount of information needed to characterize farmers' different cropping systems, the collection, processing and analysis of the data may take some time. As a result, it is often necessary to conduct several interviews with the same farmer. For the data collection, you might start with in-depth interviews and focus group discussions. However, for the techno-economic section, it is necessary to proceed with in-depth interviews, eventually with the use of questionnaires that allow for a more systematic review of all activities and values (labour, production and costs). The quantitative data needs to be entered and processed with software (e.g. Microsoft Excel). Data collection is preferably conducted in the field with the farmer but can be complemented with secondary data when available.

DESIRED OUTPUTS

For each cropping system that has been identified:

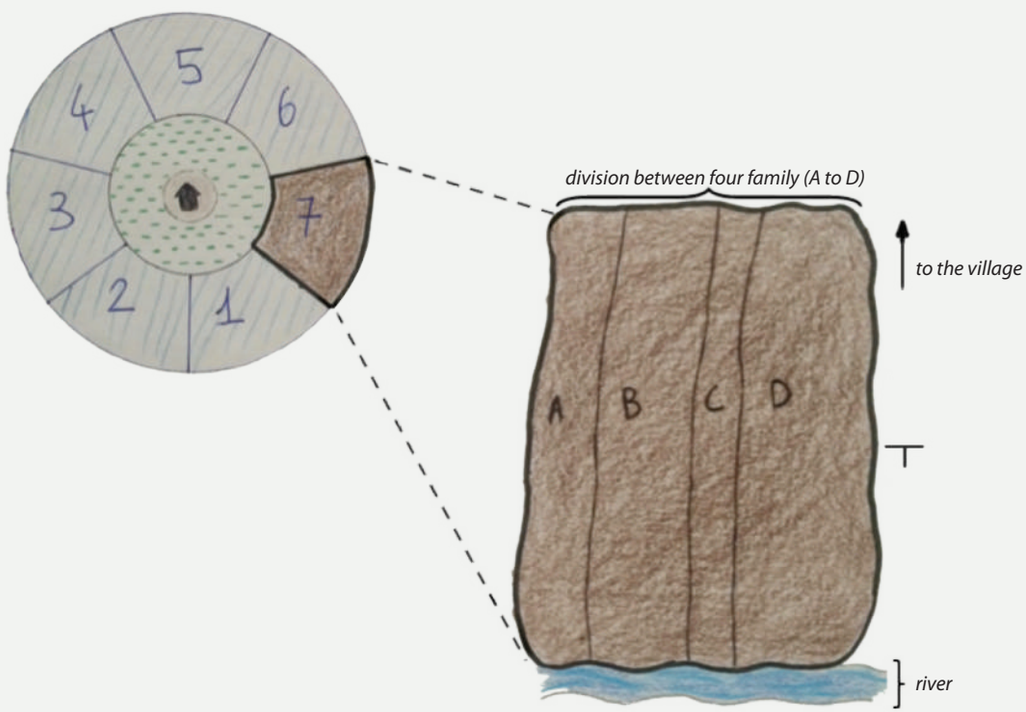
- A detailed description of the full crop rotation cycle, which brings forward the reasons for farmers' choices. This can include different types of diagrams showing the crop layout, crop sequence and rotation *(Example 9 and Example 10)*.
- Economic analysis table with information on all Intermediary Inputs, products and calculations that enable an estimation of the Gross Value-Added per year and per acre (or hectare) to be made for the whole cropping system as well as for the corresponding labour productivity per worker and per man-day *(Example 11)*.

3

Example 9—Spatial organization of a shifting cultivation (taung yar)

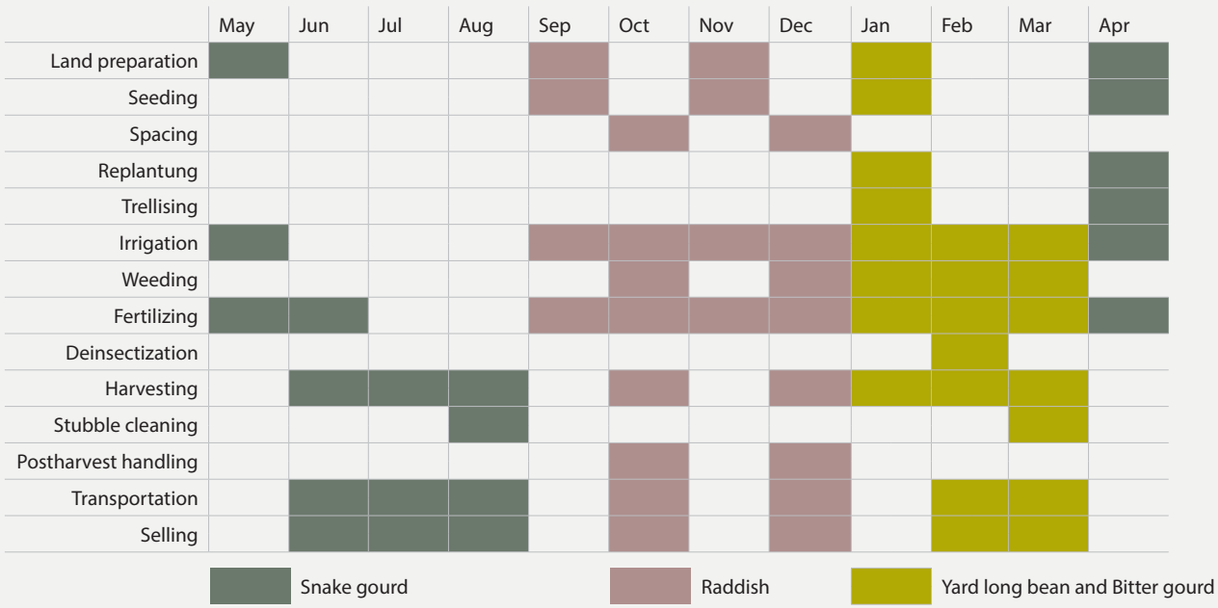
Thaundanggyi Township, Kayin State, Myanmar
Illustration by Simon AYVAYAN, 2018

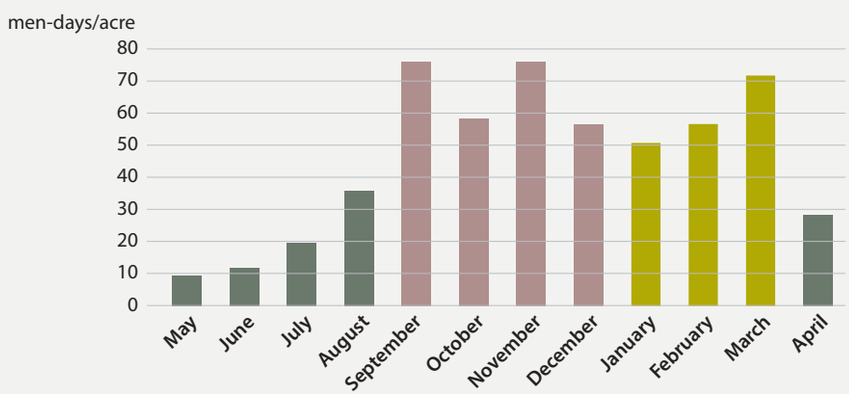
The illustration represents an area of shifting cultivation shared between four families around a particular village. Each division (from 1 to 7) is cultivated by the families who share it according to their labour capacity (plots A, B, C and D). After one year of cultivation, the group of four families moves on to cultivate the next land division (e.g. 1) while leaving division 7 fallow. And they rotate likewise for seven years until going back to division 7.



Example 10—Detailed description of one cropping system

Bogale and Mawlamyinegyun Townships, Ayeyarwady Delta, Myanmar
Illustration by Yi-Jen LU, 2017



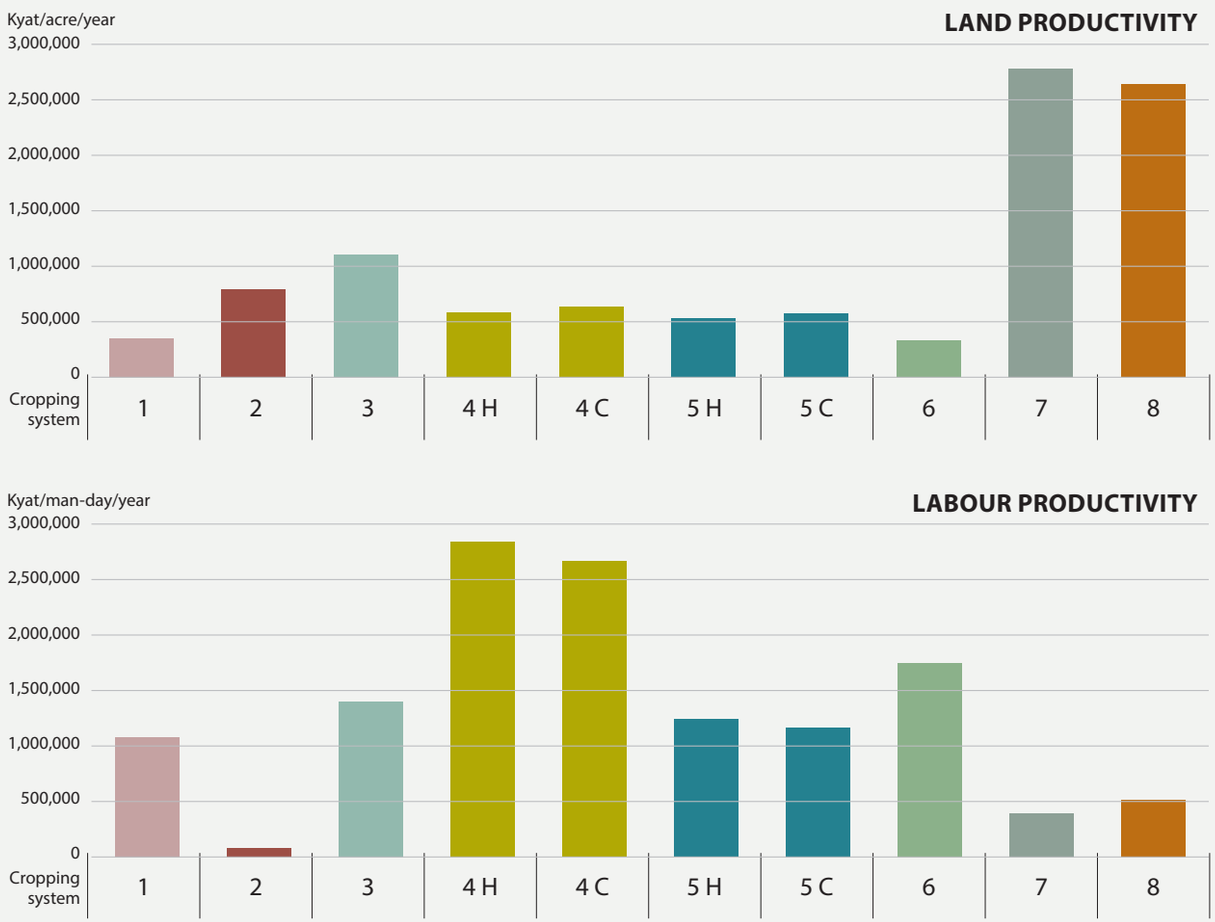


The illustration shows the labour requirements for the different activities in the cropping system (Radish / Radish / Yard long bean + Bitter gourd / Snake gourd). It shows not only how labour is distributed throughout the year but also the peak of labour requirement.

3

Example 11—Land and labour productivity for eight different cropping systems

Bogale and Mawlamyinegyun Townships Ayeyarwady Delta, Myanmar
Illustration by Yi-Jen LU, 2017



These illustrations allow for comparison of land and labour productivity between the different cropping systems identified. The graphics show, for instance, significant differences in productivity between cropping systems. Such differences need to be explained and interpreted based on the agro-ecological constraints and the technical choices made by the farmers.

C Combine-harvesting
H Hand-harvesting

1 Fallow (Monsoon season) / Broadcasted Summer Paddy
2 Chinese Watercress
3 Chinese Watercress + Fallow (Monsoon season) / Broadcasted Summer Paddy
4 Broadcasted Monsoon Paddy / Broadcasted Summer Paddy
5 Transplanted Monsoon Paddy / Broadcasted Summer Paddy
6 Broadcasted Monsoon Paddy
7 Snake gourd / Bitter gourd / Snake gourd / Bitter gourd
8 Radish / Radish / Yard long bean + Bitter gourd / Snake gourd

STEP 3.2
ANALYZE THE LIVESTOCK REARING SYSTEMS: TECHNICAL ITINERARY AND ECONOMIC PERFORMANCE

SCOPE AND CONTENT[3]

A livestock rearing system is defined as "a way of combining animals, land, workforce and other means of production in order to obtain animal products" (*Reboul, 1976*). A livestock rearing system relates to a group of animals of the same species, reared in a certain way from their birth or purchase to the end of their career. Consequently, within one farm, there can be several livestock rearing systems.

To describe the whole diversity of livestock rearing systems, the following aspects must be examined: the herd or flock, the characteristics of the form of livestock rearing, the farmer's management of the herd, the technical results (products and by-products), water and food for the animals, the animal health, the shelters for the animals, the labour calendar for livestock rearing practices, the technical limitations of the system, the forms of ownership and herding arrangements and the economic performance of the livestock rearing system:

Characteristics of the herd or flock

- The species and breed of animals reared and their genetic characteristics. A key question to ask is how does the farmer describe his/her breeds compared with other breeds?
- The different categories of animals within the herd based on gender, age and functions
- The structure of the herd (the numbers within each category).

The form of livestock rearing

In respect of fattening systems, the batch of animals included in the analysis comprises animals that arrive on the farm at a similar time, have similar characteristics, are reared together and are sold or slaughtered at a similar time. One should, therefore, determine when each batch was acquired, how old the animals were when they were acquired and how long they stayed on the farm. For breeding and fattening systems, the herd structure is more complex. To determine the economic and technical results of a livestock rearing system, a different reference base is used, depending on whether the system involves breeding or not:

- For a livestock system based purely on fattening-up animals, the results can be expressed per animal fattened
- For a livestock system that involves breeding, the results are best expressed per breeding female (e.g. cow, sow, ewe, goat or hen).

3 This section on livestock rearing system is mainly extracted from Livestock rearing systems analysis technical sheets in Barral et al. (2012).

3

The farmer's management of the herd

To describe the breeding practices, a number of key questions need to be asked:

- What type of breeding does the farmer choose? Does he/she use artificial insemination for some of the females? Or does he/she choose natural mating? If so, does he/she control the mating (choice of which males and females mate, when the male is placed with the females, and so on)? At what age are young females first used for breeding?
- Are the births grouped together? If so, at what periods do they take place? Do any difficulties occur?
- What criteria do the farmers use to select breeding males?
- At what age are the females culled? And the males?
- What is the average interval between two parturitions for any one female?
- What is the average number of live young born per litter?
- What is the mortality rate of the young before weaning?
- What is the turnover rate of breeding females? How long is the breeding career of one female?
- The technical results (products and by-products)

Milk

- Are lactation periods the same for all of the females or are they spread out?
- How long does the lactation period last for any given female (in months)? During which month does it begin and when does it end?
- To draw an approximate curve showing the trend in the quantity of milk produced by one female over the whole lactation period, ask what is the average quantity of milk obtained per day and per female?
- How is the milking done?
- What is the quality of the milk?
- How does the price of the milk vary depending on its quality?

Selling animals

- Young animals: At what age are the young males and females sold? Are they sold at a given age? Or at a given weight? Or at a variable one? How does the farmer decide when to sell? What is the selling price depending on the age of the animals, the period during which they are sold, and so on (price per animal, or per kilogram of live weight, or per kilogram of carcass weight)?
- Culled animals: At what age are the females culled? And the males? How does the farmer decide when to sell them? How many males are there in the herd? What is the estimated selling price (per live weight or per carcass weight depending on whether they are sold alive or slaughtered)?

Eggs

- How many eggs are produced per female? What is the price of the eggs?
- What does the farmer do with the products obtained from his animals? Are they sold or consumed by the family or on the farm? Does he keep the young as a form of savings? Are they given away as social or religious gifts?

Other by-products

- What other by-products does the farmer obtain from his animals and how does he use them?
  - Wool? Leather? Hides? Feathers? Birds' nests?
  - Animal dung?
  - Manure or litter (used in cropping systems for example)?

Water and food for the animals

- Water: How does the farmer ensure that his animals have water? Do they have access to a river, lake, or pond? Or do they have water brought to them? If so, who is in charge of this task (children, hired wage labour)? What happens when the herd moves? Is the herd moved especially so that it has access to water? Again, if so, who moves it?
- Assessment of the forage and fodder resources available on the farm:
  - Identify all of the areas used by the animals for grazing, and those used for producing fodder for the animals. Situate them in the ecosystem, and identify the periods when they are used.
  - Native pastures: Describe the species that grow there and their proportions. Are they grazed by the animals? How often? For how long? Are they cut for fodder? Are they fertilized? With what? When? Are the remains that the animals have not eaten cut? Are the fences maintained? Are there trees present? Are they used? For each task, determine the amount of labour involved.
  - Sown pastures: Use the same elements to describe them.
  - What other feed is produced (e.g. crop residues, grain) or purchased? At what period(s) of the year is it given to the animals and in what quantities? Who herds the animals? Are workers employed as herders?

Animal health

- Are there any health difficulties or risks? If so, of what kind?
- How does the farmer take care of sick animals? What medication does he administer to them?
- How does the farmer detect any cases of mortality? And how does he keep a check on the animals' health?
- Does he/she give any preventive treatments? If so, does he follow a seasonal schedule for this?
- Does he/she vaccinate his animals?

Shelters for the animals

- Are the animals penned in? Do they have a shelter where they go at night or at certain times of the year?
- Does the farmer have any buildings for the animals? If so, what kind?
- Are there buildings for storing fodder or feed?
- Are the buildings designed to make some tasks easier and improve productivity? Which tasks?

3

Establishing a labour calendar for livestock rearing practices

- How many people are needed at different times of the year, and for how many animals?
- For each task, how much labour is involved?
- Over how long a period does each task take place?

The technical limitations of the system

- What constraints would need to be lifted for the farmer to be able to further develop his livestock rearing system?
  - Is she/he limited by the available forage resources? Or by the limited outlets to sell her/his produce?
  - Does she/he lack space to keep the animals or store the fodder?
  - Is there too much of a need for labour at one particular period? If so, which task requires the most labour (e.g. milking, or fetching water for the animals)?
  - Is there pressure from the local society because of potential damage to their crops?
  - Do the health risks that the animals face prevent the farmer from developing his livestock rearing system?
  - Does the farmer lack cash at the time it would be needed to develop the system further?

Forms of ownership and herding arrangements

- Do the animals belong to one or several owners?
- Who watches the animals, and what type of contract is there with the herder?

Economic performance of the livestock rearing system

To analyze the economic performance of livestock rearing systems, the logic is similar to that of cropping systems (*Toolbox 8*).

METHODS

The investigations methods mobilized here to assess the livestock rearing systems are identical to those used to examine cropping systems (*Step 3.1*). They consist mainly of detailed investigations with 5 to 10 households of each farming system combined with open interviews and focus group discussion. The reader can refer to this section for more detailed information on the methods used.

DESIRED OUTPUTS

- A detailed description of the livestock rearing system, with farmers' management practices and calendar
- The herd cycle
- Economic analysis as explained below (*Example 12 and Example 13*).

Toolbox 8—How to analyze the economic performance of livestock rearing systems?

The Gross Value-Added (GVA) gives a first indication of the wealth that can be created by a livestock rearing system in one year. Generally, the GVA is calculated per female belonging to the breeding stock, which allows the wealth created per breeding female to be estimated.

Gross Product (GP)

GP = ordinary annual product based on the technical results of the herd and the use made of the products within this livestock rearing system. GP (for an ordinary year) = total sum of the values of all of the products and by-products that leave the system (e.g. animals or meat, milk, wool, leather), whether they are sold, given away, used to pay wages, consumed by the family, and so on. It also includes the increase in animal value resulting from fattening.

Intermediate inputs (II)

II = the sum of all of the costs linked to the breeding practices, feeding the animals, veterinary costs, maintenance, and so on. Occasionally, temporary or permanent workers are employed. The cost of this labour should be deducted from the GVA in order to estimate the gross margin or the gross remuneration of family labour.

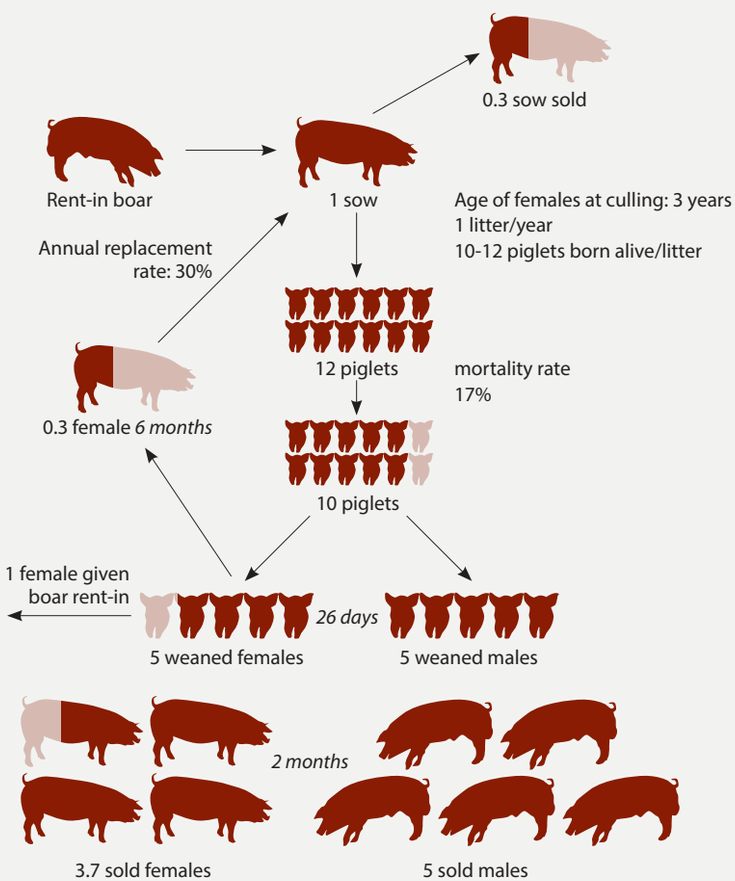
Gross value-added (GVA) GVA = GP – II

In subsequent analysis, such as the calculation of net value-added and farming income, single values of Gross Value-Added will be used for each livestock rearing system. These values are simply the average, minimum and maximum of GVA obtained for the different farms that are part of the sample. It is thus important to check that results computed from each interview are plausible and realistic.

3

Example 12—Herd cycle for pig breeding and fattening and its economic analysis

Bogale and Mawlamyinegyun, Myanmar
Adapted from Emilie Mury 2010



GROSS PRODUCT	Quantity	Live wieght	Price (kyat)	Total (Kyat)
Sale of piglets	8.7		30,000	261,000
Sale of culled sow	0.3	100	3,500	105,000
Total				**366,000**

INTERMEDIATE INPUTS Sow feed	# pigs	Period (month)	Quantity (rice flour # basket/month)	Price (kyat)	Total (kyat)
From 1 to 12 month	1	12	3	3,000	108,000
Piglets feed					
From 1 to 2 month	10	1	1	3,000	60,000
Rent-in boar	1			30,000	30,000
Total				INTERMEDIATE INPUTS	**198,000**
				GROSS VALUE ADDED	**168,000**
				GROSS VALUE ADDED PER SOW	168,000
				GROSS VALUE ADDED/MEN-DAY	8,842

The example presents the breeding approach of a pig raising system and its economic result. The illustration on the left presents how the breeding and fattening takes places, taking into account different aspects such as weaning, mortality, replacement, and so on. The figures are average values calculated for one breeding sow. The table presents the economic results of these breeding and fattening activities, expressed as Gross Value-Added and productivities (per breeding sow and per unit of labour).

Example 13—Economic analysis of duck rearing system for egg production

Bogale and Mawlamyinegyun, Myanmar
Adapted from Emilie Mury 2010

240 FEMALE DUCKS

GROSS PRODUCTS (GP)						
	Laying rate (%)	Nb of ducks laying eggs	Price per egg *(kyat)*	Total/day *(kyat)*	Total/year *(kyat)*	
Sale of eggs	65%	240	90	14,040	**5,124,600**	
INTERMEDIATE INPUTS (II)						
	Quantity/month *(baskets)*	Period *(nb of months)*	Unit Price *(kyat)*	Total costs *(kyat)*	Total costs/day *(kyat)*	Total costs/female duck *(kyat)*
From 1 day to 2 months						
Broken rice	20	2	4,000	160,000	2,700	11
Vitamines			2,000	2,000		
From 2 to 4.5 months						
Broken rice	30	2.5	4,000	300,000	4,833	20
Rice powder	7	2.5	3,000	52,500		
Dried shrimps	2		5,000	10,000		
From 4.5 to 12 months						
Broken rice	40	7.5	4,000	1,200,000	6,500	27
Rice powder	11	7.5	3,000	247,500		
Dried shrimps	3		5,000	15,000		
Purchase of ducklings	250		700	175,000		
		Total intermediate inputs per year		**2,162,000**		
			GVA (= GP - II)	**2,962,600**		
			GVA/female duck	12,344		

STEP 3.3
UNDERSTAND AND MEASURE THE CONTRIBUTION OF COMMON POOL RESOURCES

SCOPE AND CONTENT

As we noted earlier, the farmers' activity portfolio is not usually limited to cropping and livestock rearing. Their livelihoods also rely on the collection of common pool resources such as forest products or capture fisheries. In some places or for some categories of households, such activities can even be a major contribution to the family's income or self-consumption needs. It is thus important to include these activities and understand the role they play in the livelihood and the labour management strategies of the different farming systems. To do so, it is necessary to examine the following elements: the products that are collected; the equipment and labour used; the management of the resources; the processing; and the income generated.

Products

- What product are used/collected, and for what purpose?
- What particular period of the year are these products available?

Equipment

- What equipment is needed to collect these products?
- What is the value of this equipment and the possible depreciation charges?

Labour

- When are the products collected (activity conducted)? By how many people in the family? With what intensity (number of days or hours, and during what time period)?
- Who in the family?
- What are the different tasks? What are the labour requirements for these? Who performs these tasks?

Management

- What are the rules concerning the collection of these resources?
- How and by whom are these resources managed?
- Who are the authorized users?

Processing

- Does the storage of these resources require any particular installations?
- What equipment is used for extraction and for processing? What is its value?
- Do the products need a specific processing process (e.g. drying, mulling)?

Income

- For different intensities of activity and periods of collection/use, what is the value of the products collected (in one year)?
- What share is for sale, and for home consumption? What is the total value of these products based on the prevailing sale price (at village level)?
- What are the costs incurred by activities to collect resources (e.g. the purchase and reparation of materials)?
- What is the total annual income (total value – costs) generated by these activities? The income needs to be expressed per active person in that particular activity and for a given period of time. This is important as the value will be used as a reference for other households when it comes to the calculation of the family income (*Step 4.3*).

METHODS

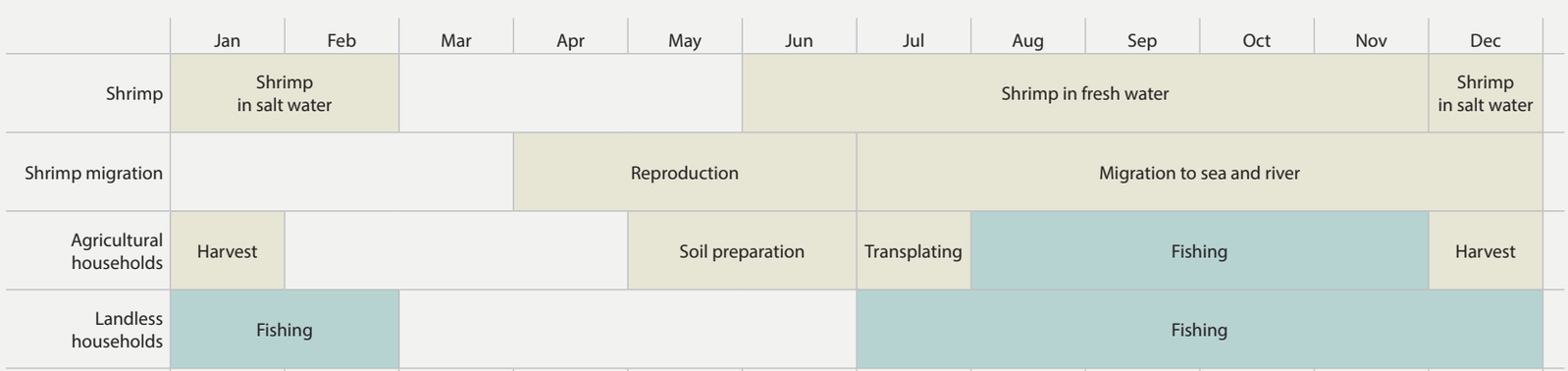
The gathering of this information is conducted through interviews. Here, again, the selection of households does not have to be based on a statistically representative sample but should rather use a purposive sampling. We recommend that 5 to 10 household of each farming system are investigated. Ideally, this investigation would be conducted with the same households interviewed earlier for cropping and livestock rearing systems. However, conducting another long interview might be overwhelming for the farmers. In this case, another group of respondents could be identified for each farming system.

DESIRED OUTPUTS

- For each product, a detailed description of the collection activity and the use of the common pool resources by the family
- A resource calendar indicating when the common pool resource products are available and the particular activity related to their collection (*Example 14*)
- An analysis of the income values (cash and self-consumption) of the products collected from common pool resources.

Example 14—Labour calendar of capture fisheries activities

Bogale Township, Myanmar



Above is an example of a fishing resource calendar extracted from a farming systems analysis in Bogale and Mawlamyinegyun Townships conducted by Emilie Mury in 2010. In this case, fishing activities are combined with the farming activity calendar to show the periods when landless people and farmers fish.

3 STEP 3.4 UNDERSTAND AND MEASURE THE CONTRIBUTION OF OFF-FARM AND NON-FARM ACTIVITIES

SCOPE AND CONTENT

Although the farming systems analysis is primarily focused on agricultural activities, agricultural wage labour "off the farm" and non-farm activities should also be considered because they can influence the way agricultural cropping or livestock rearing activities are conducted. In fact, many farming households rely on off-farm and non-farm activities to capitalize on their workforce and complement their farm income. These activities sometimes represent a significant part of the family income.

The important off-farm and non-farm activities that are prevalent in the agrarian landscape should be generally described:

- The nature and location of the activity
- The status of the labour involved: wage labour or self-employed? Seasonal or permanent? Implies migration or not?
- Profile of family members engaged in the activity: does the activity involve a particular age group of people? A particular socio-economic status? A particular farming system? What links are there with farming activities in terms of labour? Is the activity complementary to farming activities (i.e. is it conducted during the agricultural lean season) or does it appropriate agricultural labour?
- Links with farming activities in terms of investment or disinvestment: does the activity help to support farming activities or, in contrast, does it move the focus of the family activity system away from agriculture? If both, describe the context in which it does so
- What capital and investment requirements are needed to engage in this activity?
- Indication of the range of income obtained per day, week, month, season, or year (depending on what labour unit is relevant with the activity). The income needs to be expressed per active person in that particular activity and for a given period of time. This is important as the value will be used as reference for other households when it comes to the calculation of the family income (*Step 4.3*).

METHODS

The investigations methods mobilized here to assess the off-farm and non-farming activities are identical to those used to examine Common Pool Resources (*Step 3.3*). It consists mainly of interviews with five to 10 households of each farming system. The reader can refer to this section for more detailed information on the methods used.

DESIRED OUTPUTS

- A general description of off-farm and non-farm activities that are prevalent in the agrarian landscape
- A description of the reasons why off-farm and non-farm activities are practiced (or not) by certain types of farming system
- A description of the links between each of these activities within the family in terms of labour occupation and cross-investment.

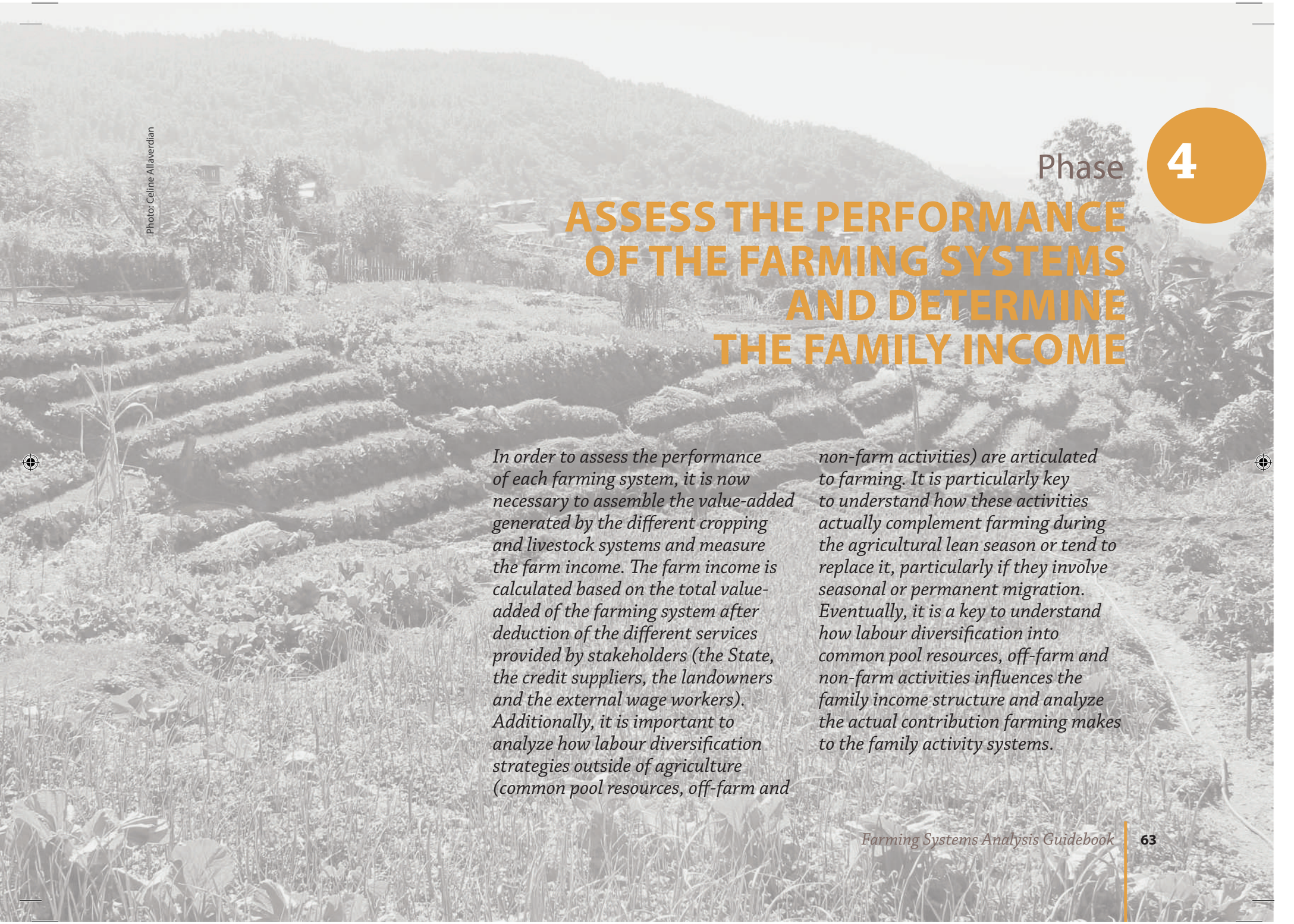


Photo: Celine Allaverdian

Phase 4

ASSESS THE PERFORMANCE OF THE FARMING SYSTEMS AND DETERMINE THE FAMILY INCOME

In order to assess the performance of each farming system, it is now necessary to assemble the value-added generated by the different cropping and livestock systems and measure the farm income. The farm income is calculated based on the total value-added of the farming system after deduction of the different services provided by stakeholders (the State, the credit suppliers, the landowners and the external wage workers). Additionally, it is important to analyze how labour diversification strategies outside of agriculture (common pool resources, off-farm and non-farm activities) are articulated to farming. It is particularly key to understand how these activities actually complement farming during the agricultural lean season or tend to replace it, particularly if they involve seasonal or permanent migration. Eventually, it is a key to understand how labour diversification into common pool resources, off-farm and non-farm activities influences the family income structure and analyze the actual contribution farming makes to the family activity systems.

4 STEP 4.1 DETERMINE AND ANALYZE THE FARM INCOME OF EACH FARMING SYSTEM

SCOPE AND CONTENT

The farm income offers a useful metric value to compare the performance of farming systems. The calculation of the farm income requires a synthesis of some key elements of the farming systems analysis such as the farming systems typology, value-added of cropping and livestock systems and the conditions of access to resources mobilized in the production process (ground/land rent, remuneration of the outside workforce, interest on borrowed capital, taxes on land and products), in addition to subsidies *(Cochet, 2015)*.

Determine the farm income

In order to determine the farm income, a model of each farming system is first established to characterize its structure and dimension (active labour, type and size of cropping and livestock rearing systems and type of equipment). This forms a basis to calculate the Gross Value-Added for the farming system.

The Net Value-Added is obtained after the fixed asset depreciation (or amortization) is factored in. It is then broken down between the value of the services that are needed to access the different factors of production (land, labour and capital). The balance left is the family farm income, i.e. the remuneration of the family workforce (*Toolbox 9*). Where relevant, farm subsidies received by the farmers need to be taken into account in the farm income as well.

In family farming, the biggest share of Gross Value-Added produced is generally allocated to the family in the form of income, except in situations where land access conditions impose a heavy ground rent (share-cropping) or where access to capital, via all sorts of contractual arrangements (reverse tenancy in particular), drastically reduces the share of value-added going to the farmer *(Cochet, 2015)*.

Toolbox 9—How to determine the farm income of the different farming systems?

Step 1
Determine the annual Gross Value-Added of each farming system

The Gross Value-Added of the farming systems is calculated by the addition of the average Gross Value-Added of the different cropping and livestock rearing systems established earlier (*Step 3.1 and Step 3.2*). The calculation is conducted following the example in *Annex 2*:
To synthesize the different values of GVA per type, we recommend working with the minimum, mean and maximum values. These will be used later to represent the values on a graphic.

Step 2
Calculate the Net Value-Added of the farming system

The annual Net Value-Added of the farming system is calculated by deducting the annual depreciation or amortization of the fixed assets mobilized during the production process (*Figure 8*). The annual amortization is evaluated on the basis of the actual period during which the equipment is in use, a period considered as a characteristic of the farming system.

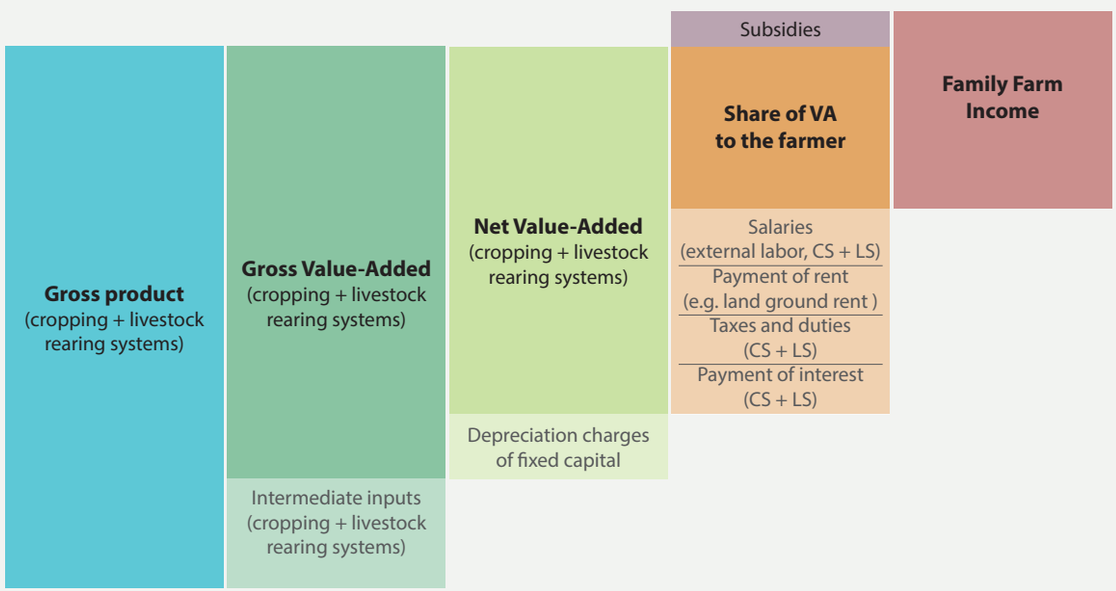


Figure 8—*Calculation and distribution of the Net Value-Added (Adapted from Cochet, 2015)*

The most common method for calculating depreciation is the straight-line method that depreciates by an equal amount every year based on two things - the original cost of the equipment and the equipment's useful lifespan which depend on its quality, and the amortization planning made by the farmer. For example, if a power-tiller has a useful lifespan of 10 years, the annual amortization is the purchase value of the power-tiller divided by 10. If the farmer purchased a five-year-old power-tiller with the same useful life duration (10 years), the annual depreciation is the price the farmer paid for the power-tiller divided by five years (=10-5). The calculation of the depreciation or amortization should be made for all fixed assets of the farming systems (cropping and the livestock systems), e.g. tractors, power-tillers, boats, animal shelters, water pumps, and so on.

Step 3
Break down the Net Value-Added (NVA) and calculate the farm income

The total annual Net Value-Added is then broken down by factoring-in the different services that have contributed or have been necessary to the production processes (*Figure 8*). These services include:

- The payment of salaries to the external workforce (wage workers)
- The payment of taxes and duties to the State (e.g. land taxes)
- The payment of rent such as the land rent
- The payment of interest rates to the credit suppliers.

The balance left after deduction of these service costs represents the share of the value-added that goes to the farmer family to remunerate their workforce. Where relevant, subsidies might be added in to the family farm income. See the example in *Annex 3*.

4

Compare and analyze the farm income of the different farming systems

Once the farm incomes are computed for the different farming systems, it is useful to compare them by plotting each household on a XY graph based on two indicators:

X = the total agricultural landholding size (expressed in acres (or hectares) per active labourer)
Y = the farm income (expressed in currency value per active labourer)

The graph is a useful way to visualize and compare the performance of the different farming systems as well as to understand the disparities of income both between and within farming systems.
It is of particular interest to compare the value of income per active labourer with the poverty line (survival threshold) and the opportunity cost of labour to produce the average income per person accessible for active labour in the agrarian landscape.

The comparison of the farm income per active labourer with both values gives a good indication of the capacity of the farming system i) to meet the needs of the family, ii) to offer the potential to expand and develop and iii) to provide a source of income that is competitive with local wage labour. Additionally, it is useful to examine the disparities of families within each farming system and the factors that explain these differences.
To make sense of differences between farming systems, it is important to bring together the different points of analysis that were made earlier in the farming systems analysis:

- The nature of the farming system
- The technical choices made by the farmers given their socio-economic constraints and the possibilities of their agro-ecological environment
- The endowment in the different factors of production
- The economic efficiency and performance of the system.

METHODS

This part of the farming systems analysis is essentially conducted through deskwork and the computation of data collected earlier, although follow-up interviews might be needed.

DESIRED OUTPUTS

- Structure of each farming system (model)
- Value-added and farming income for each farming system *(Example 15 and Example 16)*
- Graph of farm income per active labourer (Y value) against landholding size per active labourer (X value)
- comparison of the farming systems performance, with the poverty line and with the opportunity cost of labour in the agrarian landscape (including an explanation about the disparities between performances within each particular farming system)
- A discussion about the possible evolution pathways of each farming system and recommendations *(Example 17)*.

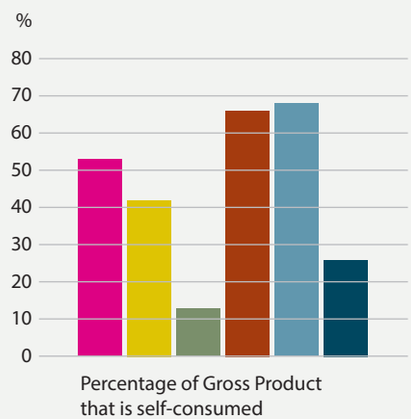
Example 15—Net Value-Added and farming income for main farming systems

Hakha Township, Chin State, Myanmar
Illustration by Clarisse Frissard and Alyssa Pritts, 2018

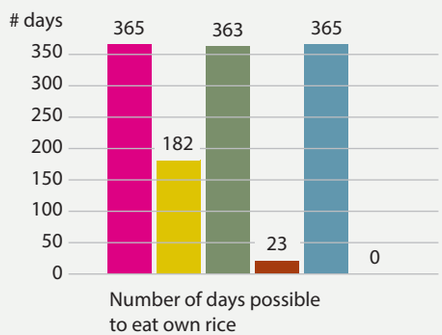
The table presents the computed values of annual Gross and Net Value-Added as well as the farming income. Values are also given relative to the number of active labourers in the family. Because this particular farming systems analysis examined the food security in Chin State, information about the food sufficiency of each farming system is provided to help interpret the total farm income.

TYPE OF FARMING SYSTEMS

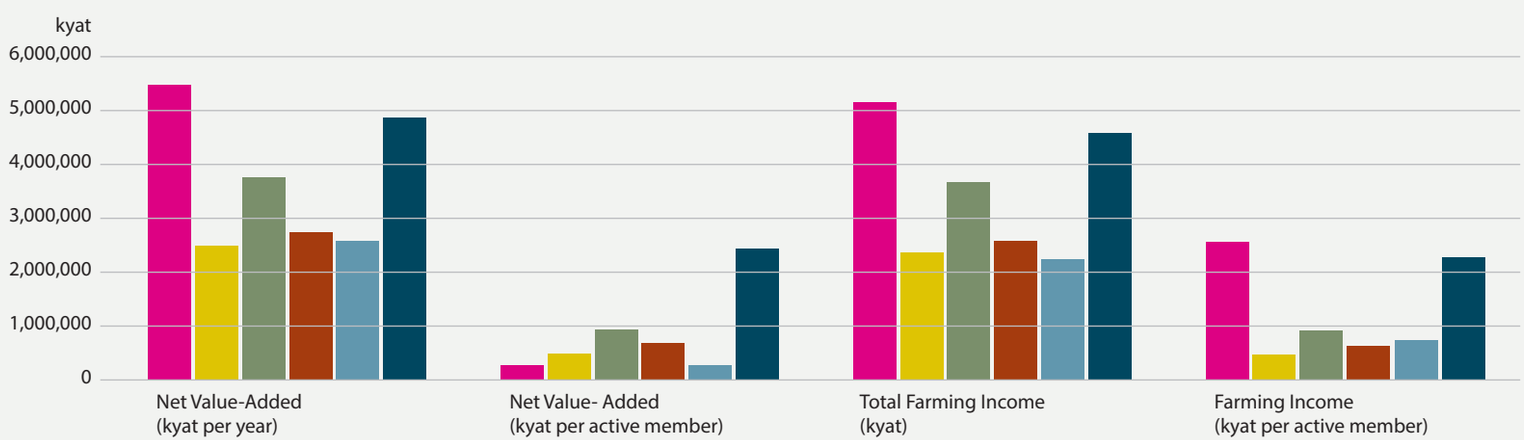
1. Large Livestock + Permanent cropping + Rice Terrace
2. Large Livestock + Shifting Cultivation + Rice Terrace
3. Large Livestock + Rice Terrace
4. Small Livestock and Shifting Cultivation
5. Large Livestock, Rice Terrace, Shifting Cultivation and Permanent Field
6. Large Livestock and Permanent Field



Percentage of Gross Product that is self-consumed



Number of days possible to eat own rice



Net Value-Added (kyat per year)

Net Value- Added (kyat per active member)

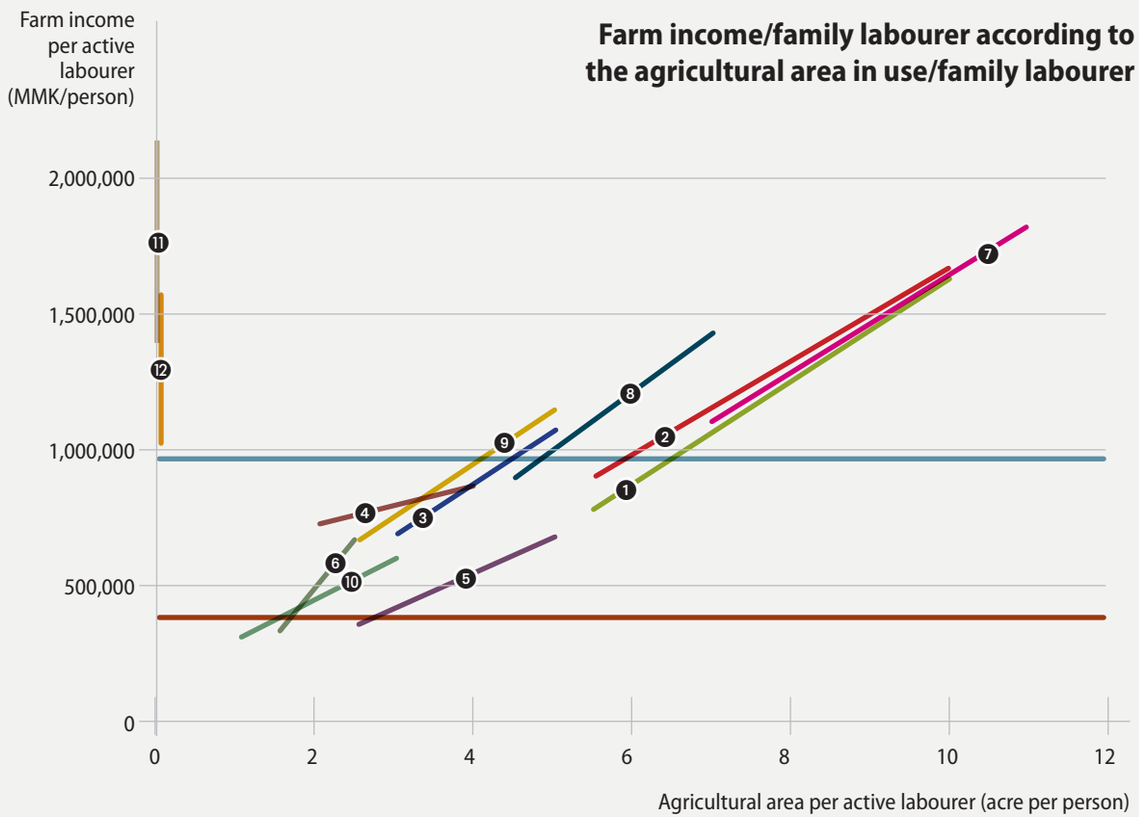
Total Farming Income (kyat)

Farming Income (kyat per active member)

4

Example 16—Comparison of the farm income/family labourer according to the agricultural area in use/family labourer

South of Budalin Township, Sagaing Region, Myanmar
Adapted from Brillion, 2015



The example allows for identification to be made of which farming systems have the highest investment capacity and remuneration of family labourers (those well above the "reproduction" threshold) and those that are most vulnerable (those located close to, or under the survival threshold).*

FARMING SYSTEMS

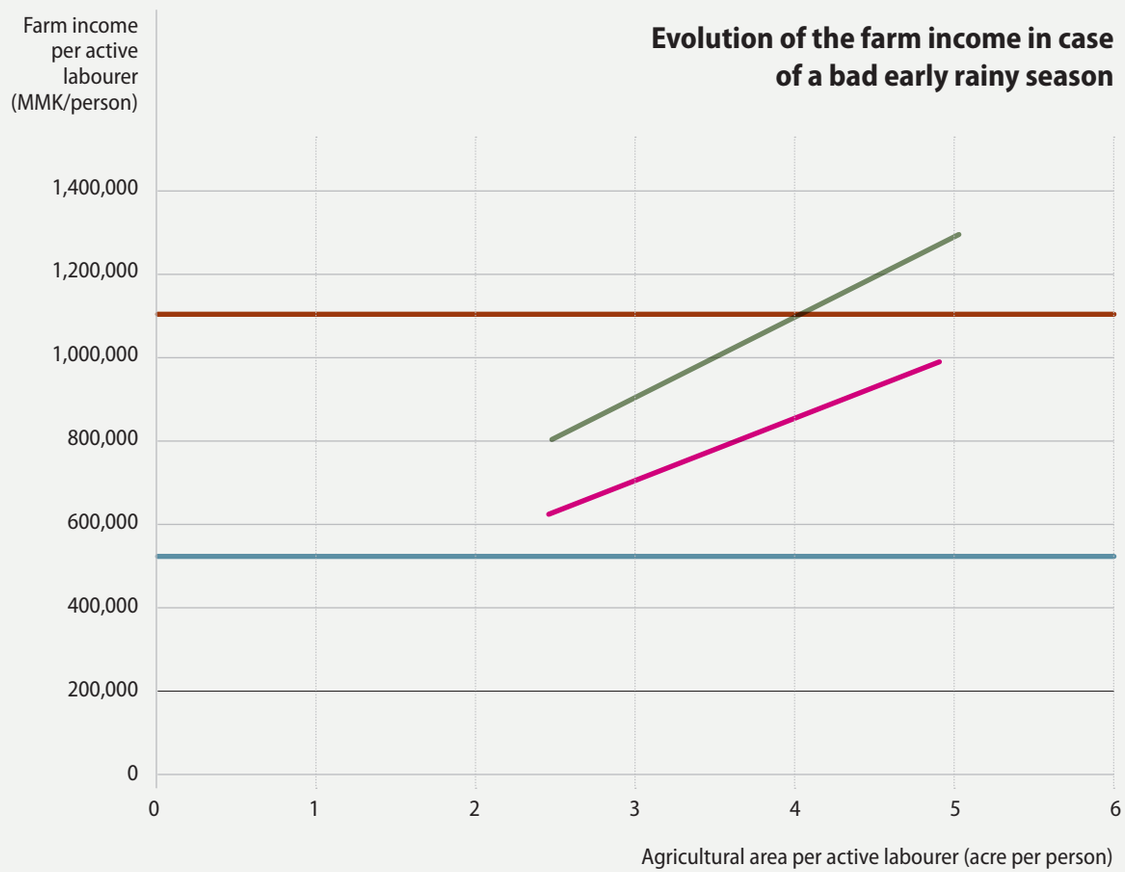
1. big area, cultivator, rice
2. big area, one pair of oxen, betel
3. average area, one pair of oxen, 2 cows, vegetables
4. small area, one pair of oxen, 7 cows, vegetables
5. average area, one pair of oxen, 2 cows, vegetables
6. small area, no draught power, vegetables
7. big area, cultivator, one pair of oxen
8. big area, two pairs of oxen
9. average area, one pair of oxen, 2 cows
10. small area, no draught cattle
11. goat breeding
12. sheep breeding

Survival threshold
Reproduction threshold

* *For the sake of clarity, only the minimum and maximum values are displayed on the graphic. The line links both values for each farming system (i.e. they are not a fitted regression)*

Example 17—Impact of bad weather scenario on the performance of a farming system

South of Budalin Township, Sagaing Region, Myanmar



In the dry zone, droughts occur relatively frequently. The resilience to such weather incidents was identified by the FSA researcher as being a key "development" issue and factor in the farming system's evolution pathways. In this case, it is relevant to create some "projections" with different scenarios. The illustration, for example, gives an indication of how one farming system can be affected by a "bad year".

FARMING SYSTEM
Early rainy season sesam

- normal year (normal yield of early rainy season sesame)
- bad year (yield of early rainy season sesame = 0)
- Survival threshold
- Reproduction threshold

4 STEP 4.2 UNDERSTAND THE LABOUR ALLOCATION STRATEGIES BETWEEN FARM AND OTHER ACTIVITIES

SCOPE AND CONTENT

Building on the economic analysis of a farming system (*Step 4.1*), we now bring in the other income-generating activities run by the family (CPR, off-farm and non-farm). The aim is to identify the labour allocation strategies operated by the families between these different activities and understand the implication of this diversification for the farm. For each farming system, the following elements are worth considering.

Understand the logic and importance of the labour diversification

- What are the periods of the year when labour diversification takes place and why is [part of] the family labour diversified outside of agriculture? Is it an absolute need (farm income is too low to ensure simple reproduction), or a way to maximize family employment during agricultural lean season? Do some members wish to move away from agriculture?
- In what activities outside of farming is family labour involved? Link this to the description of other income-generating activities given earlier (*Steps 3.3 and 3.4*)
- How many active labourers are involved in activities outside farming? For how long in each case?

A useful way to address these questions is to establish a model (archetype) of the labour occupation for each farming system, identifying the involvement of active labourers in different income generating activities for a certain period of time. The level of involvement depends of course on the situation of each family so we recommend a generalization of the particular information for the different households and an identification of any particular trends observed for each farming system in diversifying their labour occupation *(see Table on the following page)*.

The implication of labour diversification for farming

The archetypical labour calendar established earlier will allow you to gain a more intimate understanding of the consequences of labour diversification in respect of farm activities (*see below*).
Some key questions need to be answered:

- To what extent does labour diversification away from agriculture complement or replace labour allocated by the family to farming activities? What are the consequences of this for farming activities?
- Are there any labour peaks resulting from this diversification? What time of the year? How are labour peak periods managed? E.g. increase in hired-in labour, increase in farm mechanization, change in technical choices in cropping or livestock systems
- If any activities outside of agriculture replace farm labour, what are the changes in the existing cropping or livestock systems? E.g more hired-in labour or hired-in equipment, or a change in technical choices in respect of cropping or livestock systems.

Societal consequences of labour diversification

Are the patterns of labour diversification linked to changes in social relations in the agrarian landscape, e.g. increases in agricultural wage labour for certain types of farming system and land or capital accumulation? How are these socio-economic differences managed within the community?

METHODS

This part of the farming systems analysis is essentially conducted through deskwork and computation of data collected earlier, although follow-up interviews might be needed.

DESIRED OUTPUTS

- A description of labour diversification for each farming system (*Example 18*)
- For each farming system a discussion of labour diversification strategies explaining the logic, importance and consequences on farming activities, in particular how periods with either a peak or lack of labour, are managed

Farming system	Activity		No. of Active Labourer	Months 1	2	3	4	5	6	7	8	9	10	11	12
FS 1	Cropping														
	Livestock														
	Common Pool Resources														
	WAGE LABOUR	Farm *(without migration)*													
		Farm *(with migration)*													
		Non-Farm *(without migration)*													
		Non-Farm *(with migration)*													
	Self-employed or salaried non-farm activities	Without migration													
		With migration													

Format used to establish a model of labour allocation for each farming system

4

Example 18—Monthly labour allocation of family labour

Two communes of Kampong Thom, Cambodia
Illustration by Diepart J.-C. 2010

The Table below describes the monthly allocation of family labour in different farming and non-farming activities. It describes the intensity with which the labour is used, the peaks of labour and the complementarity between farming and common pool resources activities, wage labour and non-farm activities.

Srayov	Households involved (%)	**Labour intensities (in men. months/household)**												
		Dry season				Rainy season								
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Agriculture/livestock	95	0,18	0,2	0,23	0,21	2,47	2,53	2,53	2,53	2,53	2,53	2,37	1,84	1,68
Fisheries	34	0,89	0,96	0,8	0,46	0,3	0,37	0,5	0,7	0,78	0,78	0,93	0,87	0,70
Agricultural wage labour	3	0,5	0,5	0,5	1	0,5	0,5	0,5	0,5	0,5	0,5	1	1	0,63
Non Farm with migration	18	1,39	1,39	1,35	1,3	1,22	1,22	1,22	1,22	1,22	1,17	1,3	1,3	1,28
Non Farm without migration	34	1,02	1,02	1,02	0,93	0,75	0,77	0,7	0,73	0,77	0,86	0,95	0,93	0,87

Trapeang Russei	Households involved (%)	**Labour intensities (in men. months/household)**												
		Dry season				Rainy season								
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Agriculture/Livestock	88	0,28	0,17	0,21	0,21	1,07	1,98	2,28	2,28	2,16	1,48	1,16	0,81	1,17
Fisheries	4	1	1	1	1	1	0,33	0,33	0,33	0,33	0,67	0,67	1	0,72
Forestry	15	1,4	1,2	1,2	1,3	0,3	0,2	0,2	0,2	0,6	1,1	1,2	1,1	0,83
Agricultural wage labour	15	1,4	1,5	1,5	1,4	1,3	1,5	1,5	1,5	1,5	1,6	1,3	1,4	1,45
Non-Farming with migration	40	1,19	1,22	1,22	1,19	0,96	0,74	0,7	0,7	0,74	0,96	1,04	1	0,97
Non farming without migration	40	1,19	1,19	1,19	1,19	0,96	0,74	0,7	0,7	0,7	0,93	1,07	1,11	0,97

STEP 4.3
DETERMINE TOTAL FAMILY INCOME

SCOPE AND CONTENT

In the continuity of the analysis of labour diversification, the total family income is further elaborated by integrating income generated from CPR, off-farm and non-farm activities (*Annex 4*). Apart from the income figures, a discussion about the income formation mechanisms in relation to the labour diversification (*Step 4.2*) is much recommended. And, in particular, it is important to understand the mutual influence of farming and non-farming income: Does non-farm helps compensate for weak farm income? If and how the non-farm income helps investment and enhances farming activities? If non-farm income disincentivizes the development of farming activities?

METHODS

This part of the farming systems analysis is essentially conducted through deskwork and computation of data collected earlier, although follow-up interviews might be needed.

DESIRED OUTPUTS

- The structure of the family income considering the whole family activity system
- A graph of total family income per active labourer (Y value) against landholding size per active labourer (X value) *(Example 19)*
- A comparison between the samples chosen of the total family farming system and the poverty line and with the opportunity cost of labour in the agrarian landscape (including an explanation of the disparities between families within each particular activity system)
- A discussion about how farm and non-farm incomes interact

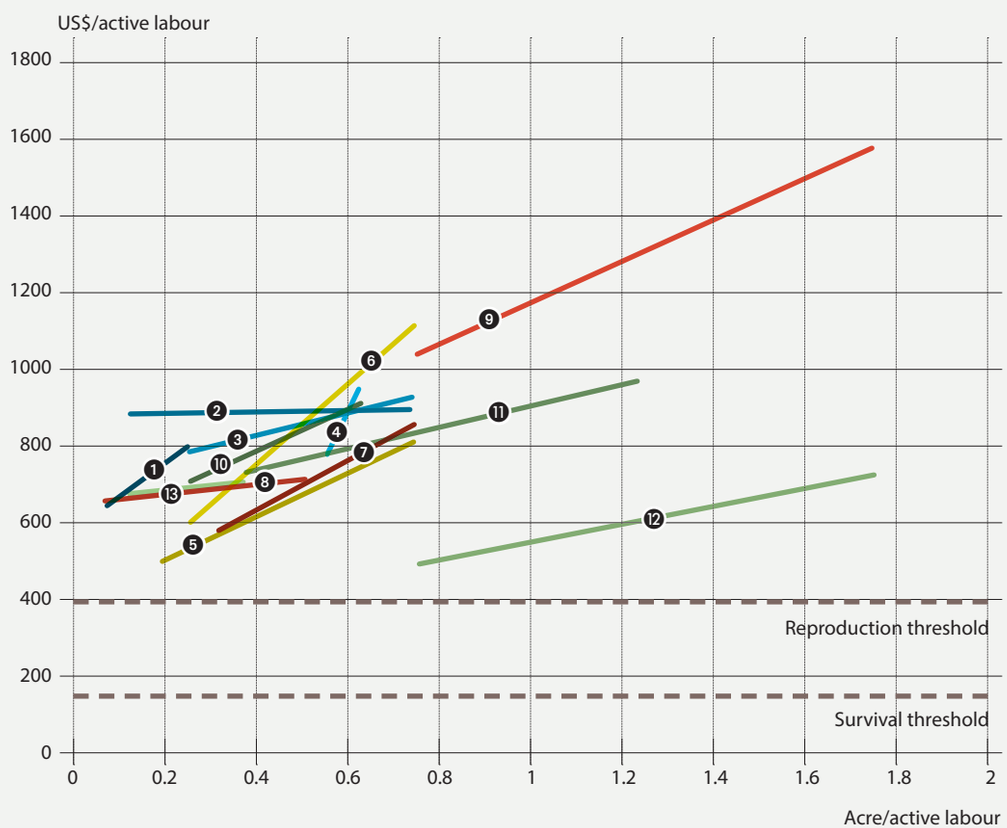
4

Example 19—Total family income of different farming system

Kampong Thom Province, Cambodia
Adapted from Lecuyer et Wiel, 2014

This graphic shows the diversity of income generated by the different members of the family. The graphic of income structure can also be put into perspective with the annual labour calendar which includes all the activities that form part of the activity system

TOTAL FAMILY INCOME PER ACTIVE LABOUR



FARMING SYSTEMS

East plain (upland)
- ❶ Rainfed rice (transplantation) and animal traction
- ❷ Rainfed rice (broadcast) and power-tiller (rent-in)
- ❸ Rainfed rice (partly transplanted) and animal traction
- ❹ Rainfed rice and orchards

East plain (lowland)
- ❺ Rainfed rice and deepwater rice with animal traction
- ❻ Rainfed rice and deepwater rice with power-tiller

Stung Sen
- ❼ Dry season rice (2 harvests) with power-tiller (own asset)
- ❽ Irrigated dry season rice (2 harvests) with power-tiller (rent-in)
- ❾ Dry season rice (2 harvests) and short receding rice

West plain (upland and lowland)
- ❿ Rainfed rice (2 harvests)
- ⓫ Rainfed rice (2 harvests) and deep-water rice
- ⓬ Rainfed rice, irrigated rice, deep-water rice and receding rice
- ⓭ Deep-water rice and power-tiller (rent-in)

CONCLUSION

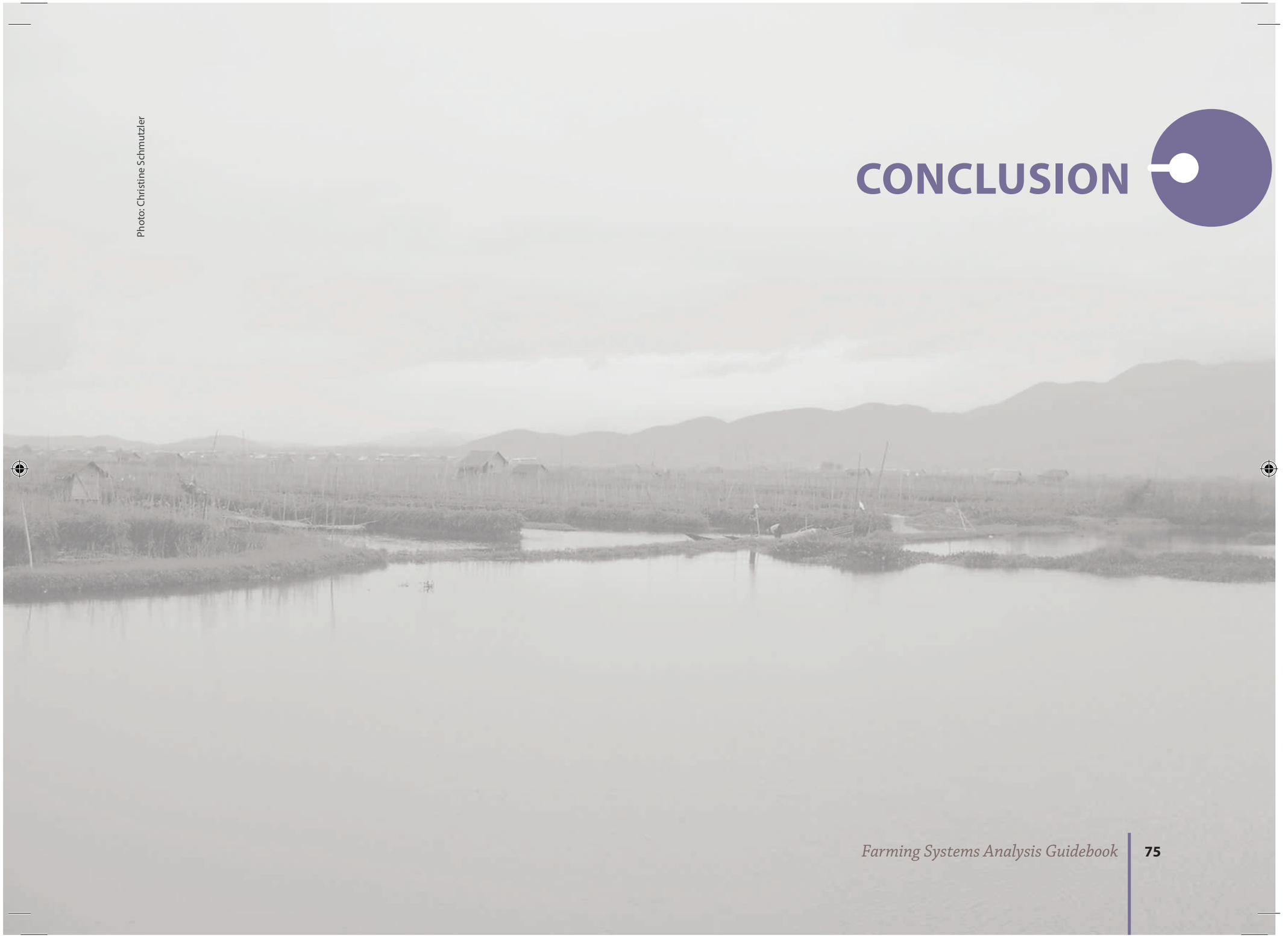


Photo: Christine Schmutzler

FROM DIAGNOSIS TO RECOMMENDATIONS

The farming systems analysis has invited the researchers on a rich journey through an agrarian landscape. But so far, the journey has been primarily driven by the researcher as an analytical and extractive exercise. The essence of the approach, however, is to generate inputs and thoughts to formulate pertinent recommendations to help support the family farmers in their own development efforts. This last phase of work needs a different angle and perspective that is not necessarily easy for a researcher to take.

The analytical approach proposed in this guidebook rests on the premise that rural landscapes are produced through a complex web of natural, socio-political, economic and cultural forces that have created diversity and differences between farming systems. In other words, the notion of differentiation is central to the FSA approach.

The differences between farming system are situated in the diversity of their agro-ecological environment. They are also produced historically through the differentiation in the access to key factors of production between families. Combined with the know-how and interest of farmers, these differences are visible in a diversity of technical choices and practices made by the farmers and eventually translate into different levels of economic performance.

Making sense of these differences is the basis for the formulation of meaningful and specific recommendations:

- Considering the close ties between the type of farming systems and its environmental context enables recommendations to be formulated that consider the specificity – both in terms of opportunities and constraints - offered by the agro-ecological environment

- The farming systems typology and all subsequent analysis has helped identify different categories or social groups of families endowed with different means of production and engaged differently in the pursuit of livelihood goals. Understanding the social, technical and economic rationality of the choices made by different categories of farmers enables recommendations to be formulated that address their particular issues and trajectories. From a social justice perspective, it is particularly important to formulate recommendations for the poorest segment of the population, and not just to hope that the introduction of a technical innovation, targeted towards successful farmers, will trickle down to them

- The FSA approach has also examined specific activities in some detail, particularly when it comes to crop and livestock production. Lessons drawn from these can help formulate recommendations beneficial to an entire sector or commodity chain.

EVALUATING THE FSA APPROACH WITH PRACTITIONERS

Parallel to the development of this guidebook, a dynamic group of national and international researchers have been involved in conducting farming systems analysis in different areas of Myanmar. Their activities were hosted by different partner organizations involved in rural development initiatives, all of whom are committed to supporting family farming. Because their interest in the farming systems analysis was so diverse at the start, the process has brought a wealth of lessons learned and experiences.
By way of conclusion, it is useful to take stock of these experience. We aim to identify the original contribution made by FSA if it is compared with other agrarian diagnostic approaches. In contrast, it is important to reflect back on the possible limitations of the approach as experienced by researchers and partner organizations and to identify ways to address those.

THE CONTRIBUTION OF THE FSA APPROACH TO DEVELOPMENT

Understanding the bigger picture

In a complex world, the FSA approach helps establish links between a large variety of elements and processes that influence family farms. By doing so, it helps draw a more holistic and rich picture of the context in which development practitioners work. Identifying underlying trends and the general context in which farmers evolve is key in linking local action and policies, in particular when it comes to ensuring sustainability of development actions. It is also useful in the context of a project working on a particular agricultural development issue, such as the access to water.

Support the design and evaluation of development projects

FSA is useful at different stages of the project cycle, from identification to impact assessment phases. The agrarian diagnostic is useful at the inception of the project because it helps provide the project with a sound understanding of the actors and the landscape in which the project operates. In fact, funding and time constraints often lead NGOs to formulate projects without in-depth understanding of their project areas. In some cases, this can lead them to overlook the context and challenges, thereby misunderstanding the multiplicity of strategies deployed by rural communities in their livelihoods. In addition, it can lead to inappropriate standardized approaches that sometimes fail to address farmers' needs. In this respect, the farming systems analysis is helpful in defining meaningful and relevant project objectives that carefully take into account the interests and knowledge of local communities. The farming systems analysis is also useful for monitoring and evaluation. It can help draw a baseline against which mid-term reviews, final evaluations, and impact assessments can be conducted. It thus helps in a reflection on the project development, and in an adjustment of project approaches and actions.

Historicize the changes in the local agrarian system

A strong contribution of the farming system approach is to embed the analysis of current practices in the deeper history of the agrarian system. The review of the agrarian history allows researchers to identify profound trends in the agricultural development of the region, which are not necessarily easy to detect. It also helps identify the particular and unusual events in the agrarian history. This is particularly important to consider for development practitioners as it might lead to project re-orientation.

Place "differences" at the centre of the analysis

While it is tempting to see uniformity and homogeneity in rural landscapes and livelihoods, the farming systems analysis puts "differences" and differentiation processes at the centre of the analysis. The approach values the variety of skills and interests among farmers, the diversity of agro-ecology conditions, the differences between categories of farming systems, the contrasts between cropping and livestock rearing techniques, and so on.

Farming systems analyses recognize that differences between farming systems are historically produced. In other words, the FSA begins with a key hypothesis that the diversity of farming systems observed today is partly a legacy of the past.

The weight of the past, combined with the different constraints and opportunities of the present and the interests of farmers, explain the variety of farming systems visible today. This variety is captured in a farming systems typology, which translates not only into different landholding sizes (or herd sizes) but also into different rationales, and technical management approaches to cropping and livestock rearing systems.

The farming systems typology allows development practitioners to formulate recommendations adapted to different farming systems, which could contribute to the better design and targeting of development actions. It also allows development practitioners to formulate recommendations that are specific to the nature and the technicality of farming systems. This approach professionalizes the discussion and goes beyond the classic sustainable livelihood approach, which places the discussion in terms of relative availability of different forms of capital (or lack thereof).

Centre labour allocation strategies in agricultural development

The question of labour is at the core of the farming systems approach. A detailed examination of family labour allocation strategies, and how these strategies evolve along the life cycle, is important in understanding the interest in, and readiness of certain categories of farmers for certain types of farm or non-farm activities.

The FSA requires practitioners to look at labour management in a holistic way, and not consider farming activities in isolation from other activities. Of particular importance is the management of labour peak periods and the growing availability of off-farm and non-farm work opportunities that compete with work on the farm.

Seek a middle way between technical support and activism

The farming systems analysis is also beneficial in articulating a discussion about support to family farmers, particularly in reconciling competing approaches between technical-support NGOs and activist groups. The farming systems analysis approach has created a space for dialogue, particularly welcoming people to discuss the future of shifting cultivation.

LIMITATIONS AND CHALLENGES FOR THE FUTURE USE OF THE APPROACH

Throughout the process, however, the coordination team and partner organizations have also identified limits to the FSA approach and to the ways in which it has been implemented.

Look at historical continuity

The second phase of the FSA process (agrarian history) inevitably leads to an identification of distinct periods that reflect particular moments of national and local history. However, it is important to look at the transition between these periods because this is often when the differentiation process is at play.

Bring non-farm issues into the farming systems analysis

The farming system approach has a strong focus on agricultural activities. Even if labour management is theoretically addressed in a holistic way, the implementation of the farming systems analysis by the book often means that the off-farm and non-farm activities are neglected. This can be quite problematic given the importance of these activities for farmers.

With the advance of agrarian transformation and the urban transition, the question of labour diversification outside agriculture cannot be ignored. What is particularly important is to understand the links between farm and non-farm activities, both in terms of labour allocation strategies and interaction in income formation mechanisms.
This problem has been partly addressed in this guidebook. However, the issue needs to be brought to the attention of researchers and development practitioners involved in the FSA process and integrated into their methodology.

Go beyond agro-ecological and economic factors

Farming systems analysis integrates a large number of parameters, but the parameters of farmers' decision-making that are not strictly economic or agro-ecological are not always considered, or are not necessarily easy to integrate within farming system models. This is problematic because these factors can be extremely important in explaining farmers' rationales and decision-making processes. These can include:

- The political economic forces that include or exclude certain groups in accessing land and natural resources
- The elements that determine the security (or lack thereof) of land tenure that might be key in explaining the level of investment farmers make in their land
- The ideological or socio-cultural constraints related to taboo, generational, or gender differences that limit certain people in doing certain things in certain ways.

In fact, the farming systems analysis approach does not exclude these parameters *a priori* but they are not necessarily explicit in the "standard" FSA approach. Not taking them into account may lead to conclusions that are scientific illusions, rather than a close representation of the real world. The researcher who conducts the analysis needs to keep them in mind throughout the process and to craft his/her own analytical tools accordingly.

Bridge the gap between diagnosis and recommendations

One of the main limitations of the FSA approach is that it does not necessarily lead to very operational recommendations. It potentially provides the space to do this, but it is not always easy for the researchers (particularly those who are inexperienced) to achieve this, as it greatly depends on their personal capacities and prior practical experience.

Need to triangulate the information

An important part of the FSA process (agrarian history, identification of differentiation processes between farming systems) essentially relies on testimony from elders and local resource people. Since they might re-construct the history as they please, it is important to cross-check the accuracy of their reports with other resource people and to triangulate information with secondary sources where possible.

Make better use of local knowledge

Another important observation made by a partner organization relates to the fact that researchers are sometimes tempted to work on their own without too much interaction with local resource people. This is partly due to the fact that the FSA methodology is quite well designed and might give the impression that researchers could work on their own. This can be problematic if the researchers work in a remote area.

Heavy requirements in terms of time and skills

Last but not least, the full-fledged farming systems analysis is a relatively lengthy process. The classical FSA approach, as conducted individually by university scholars, often takes five to six months with intensive fieldwork (four to five months) and sufficient time (one to two months) for data processing, analysis, and report writing. But in fact, the FSA approach is very flexible and the methodology can be tailored for a less comprehensive research approach and specifically focus on research and/or development questions. The researcher's ability to adapt the FSA methodology to his or her specific needs, questions and means (in terms of resources and time) is also essential.

To cope with these various issues it is also possible to "hybridize" the FSA approach with rapid appraisals and methodologies, such as Participatory Rural Appraisals (PRA). The output would of course be very different, and it would not be as detailed and comprehensive as a "classical" FSA. For example, it is sometimes relevant to conduct a rapid "FSA" following the same methodological sequence (landscape analysis, history analysis, analysis of cropping systems and livestock systems and activity systems, analysis and comparison of farming systems) using participatory tools and regular validation processes with the community.

If the farming systems analysis is conceived in the context of a particular development project, one could easily use a fully-fledged FSA as a baseline survey to become familiar with the context and to identify the project objectives, thus using a "rapid FSA" as a mid-term and final evaluation tool to assess the progress and impact of the project.

The holistic and multidisciplinary approach of the FSA requires researchers to have a sufficient skillset in various disciplines, adequate knowledge in different fields of interest (e.g. history, soil science, socio-anthropology, agro-economics) as well as the personality and sensitivity to conduct field work in a humble fashion and engage in real dialogue with farmers. It is not always easy to find researchers who meet all of these requirements in terms of skills, knowledge, and behaviour.

ANNEXES

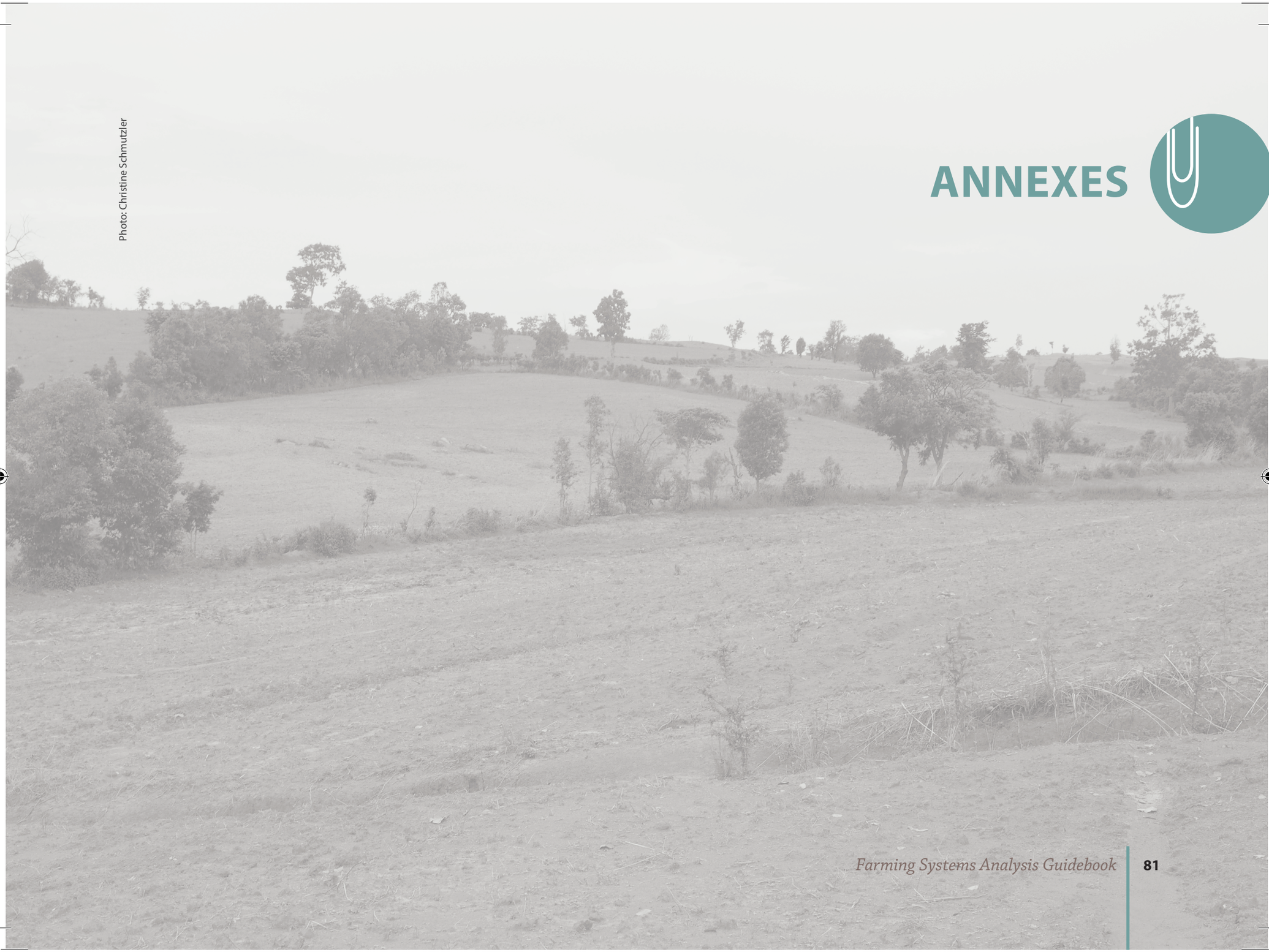


Photo: Christine Schmutzler

ANNEX 1
Research tools and interviews in the farming systems analysis

	Visual observation (sketch mapping, etc.)	Mapping (virtual or real)	Transect Walk	Literature review	Key Informant Interviews Focus Group Discussion on agrarian history	Land Use Change Analysis	Adhoc interviews (purposive sampling)	Detailed Household interviews (part 1)	Detailed Household interviews (part 2)	Economic Modelling
1. UNDERSTAND THE AGRARIAN LANDSCAPE										
1.1 Observe the agrarian landscape										
1.2 Identify agro-ecological zones										
1.3 Describe each agro-ecological zone in detail										
2. STUDY THE AGRARIAN HISTORY AND IDENTIFY FARMING SYSTEMS										
2.1 Understand historical changes										
2.2 Examine agrarian transformations at landscape level										
2.3 Analyze differentiation processes between family farming systems										
3. ANALYZE THE CROPPING AND LIVESTOCK SYSTEMS AND OTHER INCOME-GENERATING ACTIVITIES										
3.1 + 3.2 Analyze the cropping and livestock rearing systems: technical itinerary and economic performance								5-10 HH per FS		
3.3 Understand and estimate the contribution of common pool resources									5-10 HH per FS	
3.4 Understand and measure the contribution of non-farm and off-fram activities									5-10 HH per FS	
4. ASSESS THE PERFORMANCE OF THE FARMING SYSTEMS AND DETERMINE THE FAMILY INCOME										
4.1 Determine and analyze the farm income of each farming system										
4.2 Understand the labour allocation strategies between farm and other activities										
4.3 Determine total family income										

ANNEX 2
Table for calculation of Gross Value-Added

FARMING SYSTEM			FS 1			FS 2			FS Y		
			FS 1 – 1	FS 1 – 2	FS 1 – i	FS 2 – 1	FS 2 – 2	FS 2 – j	FS Y – 1	FS Y – 2	FS Y – o
Active labourer		(1)									
Land size		(2)									
Land size/active labourer		(3) = (2) / (1)									
Cropping system	Type	(4)									
	GVA/ha/year	(5) see step 3.1									
	Size (ha)	(6)									
	GVA/year	(7) = (5) x (6)									
Livestock rearing system	Type	(8)									
	GVA/ha/year	(9) see step 3.2									
	Size	(10)									
	GVA/year	(11) = (9) x (11)									
Total GVA/year		(12) = (7) + (11)									
Total GVA/year/active labourer		(13) = (12) / (1)									

FS1: Farming System Type 1
FS 1 – 1: Family 1 within Farming System Type 1
Y = total number of FS identified
i = total number of families in FS1
j = total number of families in FS2
o = total number of families in FSY
(5): see step 3.1
(9): see step 3.2

ANNEX 3
Table for calculation of farming income

FARMING SYSTEM		FS 1			FS 2			FS Y		
		FS 1 – 1	FS 1 – 2	FS 1 – i	FS 2 – 1	FS 2 – 2	FS 2 – j	FS Y – 1	FS Y – 2	FS Y – o
Active labourer	(1)									
Total GVA/year	(12)									
Depreciation	(13)									
Total NVA/year	(14) = (12) - (13)									
External labour	(15)									
Land rent	(16)									
Land taxes	(17)									
Other taxes	(18)									
Interest of credit borrowed	(19)									
Subsidies	(20)									
Farming income	(21) = (14) - (15) - (16) - (17) - (18) - (19) + (20)									
Farming income/active labourer	(22) = (21) / (1)									

FS1: Farming System Type 1
FS 1 – 1: Family 1 within Farming System Type 1
Y = total number of FS identified
i = total number of families in FS1
j = total number of families in FS2
o = total number of families in FSY

ANNEX 4
Table for calculation of family income

FARMING SYSTEM				FS 1			FS 2			FS Y		
				FS 1 – 1	FS 1 – 2	FS 1 – i	FS 2 – 1	FS 2 – 2	FS 2 – j	FS Y – 1	FS Y – 2	FS Y – o
Active labourer			(1)									
Land size			(2)									
Land size/active labourer			(3) = (2) / (1)									
Farm income			(4)									
CPR			(5)									
Wage labour	in Farming (off-farm)	Non Migration	(6)									
		Migration (remittances)	(7)									
	Non-Farm	Non Migration	(8)									
		Migration (remittances)	(9)									
Self-employed Non-Farm	Non Migration		(10)									
	Migration (remittances)		(11)									
Total family income			(12) = (4) + (5) + (6) + (7) + (8) + (9) + (10) + (11)									
Total family income / active labourer			(13) = (12) / (1)									

The approach presented here is self-explanatory. However, the values inputted in the calculation might be of a different origin based on the conditions encountered during the field investigation. If the researcher managed to obtain information about other income generating activities (CPR, off-farm and non-farm, *Steps 3.3 and 3.4*) with the same households interviewed on the cropping and livestock rearing system (*Steps 3.1 and 3.2*), the match between the farming income and that acquired from other activities is obvious. However, if the households interviewed are not the same, the research needs to come up with a plausible estimation based on the particular situation of the family and the income calculated in *Steps 3.3 and 3.4*

FS1: Farming System Type 1
FS 1 – 1: Family 1 within Farming System Type 1
Y = total number of FS identified
i = total number of families in FS1
j = total number of families in FS2
o = total number of families in FSY

REFERENCES

Allaverdian, C., Fogerite, J., Scurrah N. and Si Thu Htike San (2017). *Documenting Customary Tenure in Myanmar: A guidebook*. 2nd Edition. MRLG guidebook #1. Vientiane & Yangon: Mekong Region Land Governance.

Barral, Stéphanie, Isabelle Touzard, Nicolas Ferraton, Elisabeth Rasse-Mercat, and Didier Pillot. 2012. *Assessing Smallholder Farming: Diagnostic Analysis of Family-Based Agricultural Systems in a Small Region. Illustrated with the Case Study of the Giham Pioneer Front, Sumatra, Indonesia*. Los Baños, Laguna, Philippines: Southeast Asian Regional Center for Graduate Study and Research in Agriculture College (SEARCA).

BPSPWG. 2009. *Battambang Spatial Plan 2010-2030.* Battambang: Battambang Provincial Department of Land Management, Urban Planning, Construction and Cadastre.

Cochet, Hubert. 2015. *Comparative Agriculture*. Éditions Q. London: Springer. doi:DOI 10.1007/978-94-017-9828-0.

Cochet, Hubert, Michel Brochet, Zana Ouattara, and Véronique Boussou. 2002. *Démarche d'Etude Des Systèmes de Production de La Région de Korhogo-Koulokakaha-Gbonzoro En Cote d'Ivoire*. AgriDoc. GRET.

Cochet, Hubert, and Sophie Devienne. 2012. Foreword. In *Assessing Smallholder Farming: Diagnostic Analysis of Family-Based Agricutlural Systems in a Small Region. Illustrated Wtih the Case Study of the Giham Pionner Front, Sumatra, Indonesia*. Los Baños, Laguna, Philippines: Southeast Asian Regional Center for Graduate Study and Research in Agriculture College(SEARCA).

Crozier, Michel, and Erhard Friedberg. 1977. *L'Acteur et Le Système. Les Contraintes de l'action Collective*. Le Seuil. Paris, France.

Deffontaines, Jean-Pierre. 1991. *Champ in Histoires de Géographes*. In *Histoires de Géographes (pp. 27–42)*. Mémoires et Documents de géographie, CNRS.

Diepart, J.-C., and T. Sem. 2018. Fragmented Territories: Incomplete Enclosures and Agrarian Change on the Agricultural Frontier of Samlaut District, North-West Cambodia. *Journal of Agrarian Change* 18 (1): 156-177. doi:10.1111/joac.12155.

FAO. 1996. Agro-Ecological Zoning Guidelines. *FAO Soils Bulletin 76*, 3–5.

Garner, Elizabeth, and Ana Paula de la O Campos. 2014. *Identifying the Family Farm*. ESA Working Paper, no. 14: 1–30.

Mazoyer, Marcel, and Laurence Roudart. 2002. *Histoire Des Agricultures Du Monde. Du Néolitique à La Crise Contemporaine*. Paris: Editions du Seuil.

Sadoulet, David, Jean-Christophe Castella, Vu Hai Nam, and Dang Dinh Quang. 2002. A Short History of Land Use Changes and Farming System Differentiation in Xuat Hoa Commune, Bac Kan Province, Viet Nam. In *Doi Moi in the Mountains. Land Use Changes and Farmers Livelihood Strategies in Bac Kan Province, Viet Nam (pp. 21–46)*, edited by Jean-Christophe Castella and Dang Dinh Quang,. Hanoi: The Agricultural Publishing House.

Sébillotte, Michel. 1976. *Jachère, Système de Culture, Système de Production*. Paris, France: Institut National Agronomique Paris Grignon.

Farming Systems Analysis conducted as part of this project

Ayvayan, Simon (2018). *The evolution of farming systems in the Northern part of the Thaundanggyi Township, Kayin state, Myanmar*. Yangon, Myanmar, CDN-ZOA-GRET-LIFT

Frissard, Clarisse and Pritts, Alyssa (2018). *The Evolution of Farming Systems and Diet in Hakha Township, Chin State, Myanmar*, GRET – LIFT

García, Adriana Isabel (2018). *Farming System Analysis in Labutta and Mawlamyinegyun Townships, Ayeyarwady division, Myanmar*. Master Thesis, Master Agronomie Agro-Alimentaire, Montpelier SupAgro, Montpellier, France, GRET – METTA – LIFT

Lu, Yi-Jen (2017). *Decreased Labour Supply in the Ayeyarwady Delta, Myanmar Transformation of Farming Systems in Bogale and Mawlamyinegyun Townships*. Master Thesis, Master en Sciences et technologies de l'agriculture, de l'alimentation et de l'environnement (Montpellier SupAgro) and Master of Science, Agricultural Development (University of Copenhagen), WHH – GRET – LIFT

Mya Darli Thant (2018). *Farming Systems Analysis in Myitkyina and Waing Maw Townships, Kachin State, Myanmar*, GRET – METTA – LIFT

Yang, Fue (2017). *Farming System Analysis in Myinmu Township, Sagaing region, central Dry Zone of Myanmar (Different conditions access to irrigation water)*, Master Thesis, Master Agronomie Agro-Alimentaire, Montpelier SupAgro, Montpellier, France, IWMI – GRET – LIFT

Other Farming Systems Analysis studies used for the guidebook

Brillion, Camille (2015). *Agrarian diagnosis of a small region of Myanmar: the South of Budalin Township (Sagaing division)*. Gret – Agro Paris Tech

Mury, Emilie (2010). *Le Delta d'Ayeyarwaddy: agriculture entre terre et mer. Diagnostic agraire des cantons de Bogale et Mawlamyinegyin, division d'Ayeyarwaddy, Myanmar,* SupAgro-Gret-WHH-LIFT

Lecuyer, Charlotte and Wiel Forie-Anne (2014). *Diagnostic agraire de la plaine rizicole de Kampong Thom, Cambodge Adaptation des pratiques agricoles au changement climatique*. Agro-Paris Tech and Agence Française de Développement