“Characterization, Diagnosis & Design”

Training Exercise Book

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INTRODUCTION

Since its establishment in 1977, ICRAF has been active in supporting agroforestry training with a view to developing greater national capacity in agroforestry research and development. Each year, the Centre organizes a series of short term training courses, both at the introductory and specialist levels, for scientists, field technicians, development specialists and extension agents. This training takes place at ICRAF's headquarters in Nairobi, Kenya, as well as in collaborating countries in its mandated agro-ecological regions of the developing world; the humid, sub-humid and semi-arid tropics.

One of the main short training events is the international course on "Agroforestry Research for Integrated Land Use", a 3-week introductory course organized for the benefit of scientists, development and extension specialists and policymakers who are about to embark on agroforestry research, development, training or education activities. The main objective of this course is to introduce participants to the principles, concepts and practice of agroforestry research and development through the characterization and diagnosis of land use systems and the design of appropriate agroforestry interventions, adoptable by farmers, and research leading to their improvement.

At the core of this training course is a 3 to 4 day field exercise during which participants practice the application of farming household diagnosis and agroforestry intervention design based upon available land use characterization information at the community level. This exercise has evolved over the years to incorporate recent advances in agroforestry research and development and this exercise book has been developed in support of it.

A Southeast Asian version has now been developed in order to support the field work in the two-week training-of trainers course on *"Agroforestry for improved landuse and livelihood systems in Southeast Asia"*

THE C&D TRAINING EXERCISE BOOK

The **purpose** of this exercise book is to facilitate the preparation, coordination and implementation of a "Characterization and Diagnosis" training exercise at the farming household level for the benefit of those participating in it.

The first part of the exercise book describes the different **parts of the exercise** in detail covering the specific objectives and suggesting methods on how these can be achieved. It further lists a series of tools that can be useful to implement these parts and provides some guidelin es on how to conduct them as well as an indication on their expected outcome.

The second part describes in more detail selected participatory **diagnostic tools** that can be used during the field exercise.

The third part contains the available bio-physical and social-economic **characterization and extension information** at the community level.

The fourth part provides some **guidelines** on exercise organization and coordination for the benefit of exercise coordinators and team leaders, as well as guidelines on farmer interviews and plenary presentations of exercise results for the benefit of the participants.

Even though some parts of this exercise book (characterization) focus on a particular land use system in Mae Taeng, Thailand, its outline and the other parts of its content (exercise description, tools, guidelines) can be used to conduct similar exercises in other land use systems and agro-ecological zones. It is left up to the imagination of future exercise coordinators and team leaders to adapt the exercise book as to suit the requirements of a C&D exercise in a different context.

Attached to this exercise book is an **evaluation form** for this exercise book. Its purpose is to obtain feedback on the present version as to allow the improvement of future ones. Your collaboration in this evaluation will be greatly appreciated and by returning this information you will be kept informed about future updates of the C&D exercise book.

Lastly, please remember that this is a **training exercise book** and not instructions on how to carry out a real Characterization and Design exercise. A *"real" C*&D will entail more detailed characterization research, utilization of key informants, much larger sample sizes of farmers, more careful analysis of data,... just to name a few of the differences.

1. THE C&D TRAINING EXERCISE

1. THE "C&D" TRAINING EXERCISE

Prior to implementing the training exercise, participants should be familiar with:

- concepts and principles of agroforestry
- tree domestication and agroforestry trees
- agroforestry technologies
- land use characterization and diagnosis
- agroforestry research design
- principles and pitfalls of experimental design
- bio-physical and socio-economic evaluation of agroforestry

These topics should be covered in a series of introductory lectures leading up to the field exercise. If this is not possible, it will be useful to distribute in advance any pertaining to missing lectures.

The C&D exercise is carried out in small (5 - 8 participants) **multidisciplinary teams** under the overall responsibility of an **exercise coordinator** and the leadership of experienced **team leaders.** Guidelines on the organization, coordination and implementation of the training exercise for the benefit of exercise coordinators and team leaders are given in the last part of this exercise book.

> The general objective of the C&D exercise is:
>
> *“Based upon available land use characterization information and farming household diagnosis; to design agroforestry research and development leading to the development of agroforestry interventions, adoptable by farmers, that aim at alleviating their identified problems and constraints".*

It is important to note that this is a **training exercise** and that it is impossible to cover all of its activities in great detail as a result of the limited time. Therefore, the outcomes should not be extended to farmers or extensionists in the land use system.

The C&D exercise can be divided into **seven parts**, each contributing to its overall objective. Parts 1 to 3 deal with diagnostic aspects, parts 4 to 5 with **intervention.** P**art 6 with design of research activities and Part 7 with Design of Development activities.**

Session 5 is a crossroad session one can focus on either research (part 6) or on development (part7) depending on the objectives of the exercise. However, it must be noted that all of these parts are strongly inter—related because of the **iterative character of Diagnosis and Design**.

YOUR NOTES:

PART 1: DIAGNOSTIC TOOLS USE

This part of the exercise aims at familiarizing participants with some important diagnostic tools that will be used during the exercise. A series of such tools is described in the second part of this exercise book and explained during a theoretical presentation.

PART 2: DATA COLLECTION AND VERIFICATION

During this part of the exercise, participants familiarize themselves with a targeted farming system at the household level through the collection of data on various farmer enterprises (e.g. components, objectives, strategies,...) and their synthesis with available characterization information.

PART 3: HYPOTHESIS FORMULATION

The purpose of this part of the exercise is to analyze the data obtained in part 2 and to formulate hypotheses on problems, to prioritize these problems, to identify data required to test the hypotheses, and to identify potential interventions (agroforestry and non-agroforestry) that could alleviate them.

PART 4: HYPOTHESIS TESTING

During this part of the exercise, participants focus their fieldwork on a priority problem or constraint and its corresponding agroforestry solution through the collection of additional data, using the appropriate tools, needed to confirm their hypothesis and obtain information and feedback on potential farmer adoptability and/or adaptability of the agroforestry intervention.

PART 5: INTERVENTION DESIGN-RESEARCH PRIORITIZATION-DEVELOPMENT PRIORITIZATION

Part 5 of the exercise identifies knowledge gaps and issues in the design of this agroforestry intervention and lists:

- Priority development objectives and activities that need to be carried out in order to address these
- priority research objectives and activities that need to be carried out in order to address these.

PART 6: RESEARCH DESIGN

A final part of the exercise could consist of designing a research plan and protocol(s) that will meet one or more of the priority research objectives identified in part 5.

PART 7: DEVELOPMENT DESIGN

This part can be done instead of Part 6 or in combination with Part 7.

Another option is to round the exercise with the designing a development plan and protocol(s) that will meet one or more of the priority development objectives identified in part 5.

YOUR NOTES:

Part 1: Diagnostic tools use

Objective

- " *To practice the use of several participatory diagnostic tools that can be used to diagnose farming household problems and constraints"*

Method

- Mock exercise in the use of one or more diagnostic tools

Tools

- The following diagnostic tools could be tested:

1. Semi-structured interview (SSI)
2. Diagrams
   - 2.1. Maps
     - a) Farm layout map
     - b) Gender resources map
   - 2.2. Transects
     - a) Spatial topographical transect
     - b) Historical land use transect
   - 2.3. Calendars
     - a) Enterprises
     - b) Food availability
     - c) Livestock feed availability
     - d) Seasonal activities by gender and age
   - 2.4. Labour and resources chart
     - a) Gender and age division of labour
     - b) Benefits Analysis Flow Chart
   - 2.5. Conceptual Diagram
     - a) Farming Systems mode
     - b) Household agroecological system
3. Ranking
4. Other tools presented during the course

Guidelines

- Identify some knowledgeable persons willing to play the role of a farmer

Split into small groups and practice the use of one or more diagnostic tools that will be used during the field exercise

It is recommended to assign the responsibility for the use of one or two tools to an individual team member within each multidisciplinary group so that the group as a whole has some experience in the use of all the different tools.

Outcome

- Pre-tested tools

YOUR NOTES:

Part 2: Data collection and synthesis

Objective	• *"To collect available information and data on a targeted farming system leading to the identification and understanding of farming household problems and constraints and the formulation of hypothetical solutions that address these"*
Method	• General diagnostic interviews with selected farmers.
Tools	• The same diagnostic tools listed in part 1 can be used.
Guidelines	• Multi—disciplinary teams of participants will visit two farming households Using an appropriate semi-structured interview and/or other diagnostic tools, obtain as much relevant information and data on the farming system as possible and synthesise these with the available characterization information contained in this exercise book. Data should provide a clear understanding of the physical farming system as well as of the farmer's objectives, strategies, resources, enterprises, management, problems and risks
Outcome	• A concise, clear and analytical description of the farming system

YOUR NOTES:

Part 3: Hypothesis formulation

Objective

- *"To formulate hypotheses concerning key elements of the farming system such as:*
  - *farmer problems and constraints*
  - *farmer management strategies*[1]
  - *interventions*[2]*"*

Method

- Working group session.

Tools

- Lecture on "Participatory appraisals-and-design " (S. Franzel)
  Diagnostic tools (see part 1)
  Outcome of the data collection and verification exercise
  Characterization information

Guidelines

- Parts 1 and 2 of the exercise will give participants the necessary information to start identifying farmer problems and constraints

  During this part of the exercise, participants will formulate a series of hypotheses on problems and constraints and rank them according to importance

  Participants will also formulate hypotheses, both agroforestry and non-agroforestry, on potential interventions and solutions to these problems and constraints

  For both types of hypotheses, explain the criteria that were used to rank them and what data are required to test them.

Outcome

- Several prioritized hypotheses on farming system problems and constraints
- One or more hypotheses on potential agroforestry interventions that may alleviate them.

[1] Understanding why farmers manage an enterprise in a specific way
[2] understanding how a particular intervention could help farmers in achieving their objectives

YOUR NOTES:

Part 4: Hypothesis testing

Objective	• *"To test the hypotheses on farmer problems and constraints and their potential agroforestry solutions developed during part 3 of the exercise and to collect additional information and data needed to formulate a priority agroforestry intervention"*
Method	• Focused diagnostic field interviews with selected farmers
Tools	• Lecture on "Participatory appraisals-and-design " (S.Franzel) Adapted diagnostic tools
Guidelines	• Part 3 of the field exercise will have yielded a series of hypotheses on farmer problems and constraints and on their possible solutions. During this part of the exercise, participants will test these hypotheses with the farmers and further prioritize problems and constraints according to importance (severity, numbers of farmers affected and farmers’ priorities) Participants also describe one or more potential (agroforestry) interventions that will address one or several farmers identified problem(s) and constraint(s) and that are expected to be adoptable by farmers.
Outcome	• A detailed description (components, inputs, management, outputs, niche, policies,...) of an (agroforestry) intervention and why it is expected to be successful

YOUR NOTES:

Part 5: Intervention design - Research prioritization – Development prioritization

Objective

- *"Based on the available data and feedback obtained from the farmers on a potential agroforestry intervention:*
  - *to identify gaps in knowledge and issues regarding that interventions*
  - *to prioritise research needs to fill those gaps*
  - *to identify and prioritize development needs*

Method

- Working group discussions.

Tools

- "Framework for thought in technology design"
  Lecture on "Agroforestry research design" (P. Cooper)
  Agroforestree database
  "Social Evaluation of Agroforestry" (F. Place)
  "Economic Evaluation of Agroforestry' (D. Hoekstra)

Guidelines

- The outcome of the previous part (4) of the exercise will have identified none, one, or several, hypothetical intervention(s) as feasible (verified) solution(s) to a constraint.

  If more than one intervention has been identified, select one to continue working with.

  Considering all available information, analyse what is known about this intervention in the context of the farming system under study

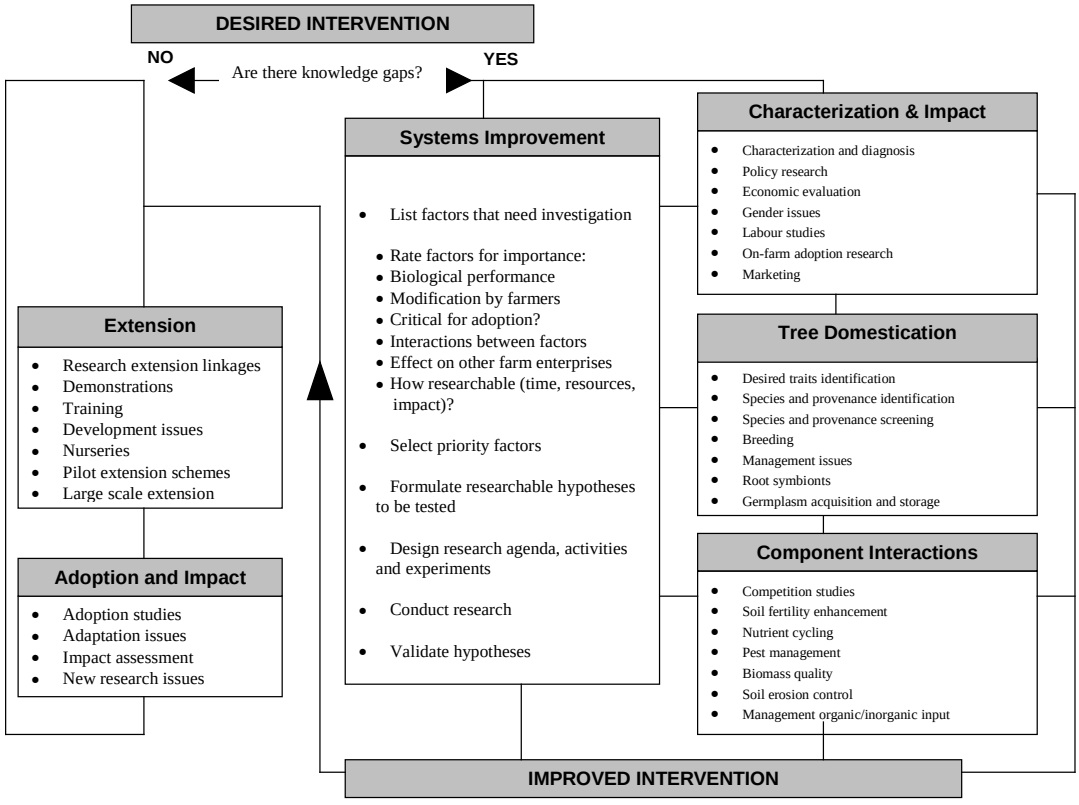
  Use the "Framework for thought on technology design" to:

  - identify knowledge gaps
  - identify the type of research (biophysical, socio-economic, policy) needed to address these
  - develop and prioritise detailed research objectives

Outcome

- An **agroforestry intervention** specified in terms of objectives, components, management and outputs, together **with detailed research objectives** that must be formulated before the intervention can be initiated

YOUR NOTES:



“Framework for thought in agroforestry technology design”

YOUR NOTES:

Part 6: Research design

Objective	• *"To design research protocols that meet research objectives"*
Method	• Working group discussions followed by plenary presentations
Tools	• "Checklist for designing on-station agroforestry experiments" Lecture on "Experimental design in agroforestry" (R. Coe) "Experiments database" ICRAF
Guidelines	• The outcome of Part 5 of the exercise will have identified several areas that require research with detailed objectives for such research. Select one or more research objectives and design research plans and protocols to meet these
Outcome	• A detailed research plan to meet the research objectives that have been identified

YOUR NOTES:

Part 7: Development design

Objective	• *"To design development plans adapted to the needs* "
Method	• Working group discussions followed by plenary presentations
Tools	• Lecture on Participatory Project Development (Dr. Komon Pragtong) • Lecture on Community Organizing (Dr. Pearmsak Makarabhirom)
Guidelines	• The outcome of Part 5 of the exercise will have identified several areas that require development with detailed objectives for such research. Select one or more development objectives and design a development plan to meet these.
Outcome	• A detailed development plan to meet the development objectives that have been identified

YOUR NOTES:

PLENARY PRESENTATIONS

Each group will prepare a plenary presentation lasting 15-20 minutes. A possible format for the presentations is as follows:

1. Description of a farming system (if same for all groups, this section need not be repeated by all groups in the plenary)
2. A list of farmer problems
3. The target problem major hypotheses
4. Testing of the hypotheses
5. Description of an intervention
6. Further research needs
7. Development plan

During the course of the presentation, each group should try to include an example of use of at least one diagnostic tool (aside from the interview itself).

2. DIAGNOSTIC TRAINING EXERCISE

2. DIAGNOSTIC TOOLS

Various participatory diagnostic tools can be used to describe and comprehend the realities of farming systems and households. The following is a list of the more useful ones in the context of this field exercise. Each one is briefly described with an example on the following pages. Do note that several tools can be used in combination to diagnose a problem.

DIAGNOSTIC TOOLS

1. **Semi-structured interview (SSI)**

2. **Diagrams:**

   2.1. Maps
   - **a) Farm layout map**
   - **b) Gender resources map**

   2.2. Transects
   - **a) Spatial topographical transect**
   - **b) Historical land use transect**

   2.3. Calendars
   - **a) Enterprises**
   - **b) Food availability**
   - **c) Livestock feed availability**
   - **d) Seasonal activities by gender and age**

   2.4. Labour and resources charts
   - **a) Gender and age division of labour**
   - **b) Benefits Analysis Flow Chart**

   2.5. Conceptual Diagram
   - **a) Farming systems model**
   - **b) Household agroecological system**
   - **c) Cause and effect**

3. **Ranking**

All of these tools are used in a "participatory" fashion allowing the teams to interact with farmers and other informants during the exercise. Consult the "Guidelines for farmer interviews" further on in this exercise book.

2.1 SEMI-STRUCTURED INTERVIEW (SSI)

Definition

- A guided and informal interview where only some of the questions are predetermined in the form of a checklist (list of topics) and other relevant ones arise during the interview based upon observations, responses, topics the farmer wishes to discuss, interviewer background and experience, the use of other tools (farm map, ranking, calendars,...).

Purpose

- To collect a wide range of qualitative and quantitative information while allowing respondents and interviewers the flexibility to pursue topics of interest

Types

- Individual interview (representative information)
  Key informant interview (specialist information)
  Group interview (community level information)
  Focus group discussion (specific topics)

Characteristics

- Informal, conversational but controlled
  Uses a checklist, not a formal questionnaire
  Open-ended questions
  Allows new issues to arise
  Leads to new hypotheses
  Allows collection of quantitative data (w hen? how much? how long? how many?...)

Useful hints

- Develop an appropriate checklist based upon the objectives of the interviews.
- The following pages give an example of a checklist consisting of two parts:
  - a "general description" checklist to obtain biophysical and socio-economic information on the farming household
  - a "farming enterprises" checklist to obtain information on farming household objectives, strategies, problems and constraints

Example

- Observe the do's and don’t’s of farmer interviews as outlined in the "Guidelines" of this exercise book.
- To develop an understanding of the different methods a farmer uses for maintaining soil fertility and the advantages and disadvantages of each method.

SEMI-STRUCTURED INTERVIEW (SSI)

INTERVIEW OUTLINE

1. State the purpose of the visit
2. Introduce individual members of the team and countries of origin
3. Establish rapport with respondents through brief casual discussion and try to include entire farm family
4. Ask general questions about the community and farming household (see checklists)
5. Ask more detailed questions about identified needs, enterprises, resources, niches, etc... (see checklists)
6. Allow household members to ask any questions throughout and at the end
7. Thank the farm family for their contribution

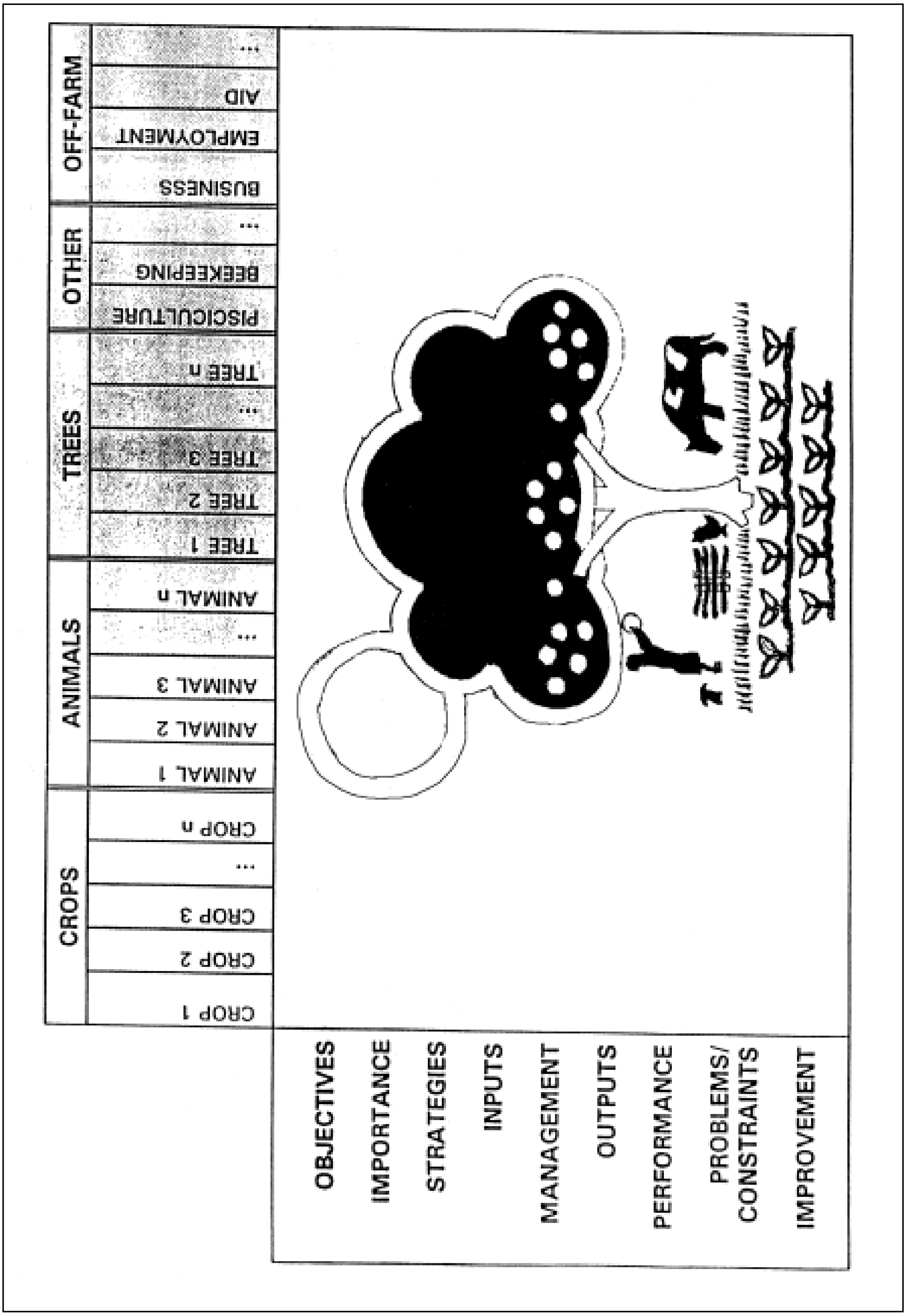
Follow the useful hints on pages 4-10 to 4-12

a) GENERAL HOUSEHOLD CHARACTERISTICS

The following checklist of topics for a general diagnosis survey. These topics are not exhaustive and are not to be construed as questions. For each topic listed, the interviewer should always try to probe the farmer as to why or why not certain data are observed. Be aware of men's and women's separate, complementary, or interchangeable cable roles in each topic area. Answers to questions can also lead into further probing on detailed topics not included in this list.

TOPIC	POSSIBLE QUESTIONS, OBSERVATIONS, COMMENTS
GENERAL TOPICS T0 BEGIN DIALOGUE	- Year began farming at site - Farming enterprises such as crops, trees, livestock - Changes in selection of enterprises over time
LAND	
Location Pattern	- geographical location of farm - size of farm, number of parcels, distance to house, area under cultivation
Quality	- slope, topography, soil fertility levels, access to water
Tenure	- how acquired, rights to use or transfer; access, control and responsibilities of men and women, availability for expansion, tree tenure
Off farm lands	- access to forest, water, grazing and other collection areas
LABOUR	
Household Structure	- number of generations, gender of head, marital status
Labour available	- family size, number of family and other workers, hired labour
Activities	- farming, domestic, gathering, off-farm activities, activities which are paid and unpaid, activities of men and women
Demands on labour	- peak and slack periods

TOPIC	POSSIBLE QUESTIONS, OBSERVATIONS COMMENTS
CAPITAL	
Inventory	- principal tools, equipment, machinery, draft power, and buildings owned
Income	- major sources of income -- on and off-farm, who on farm receives
Credit	- availability of credit, from whom and for what purpose, what are the requirements and who receives
HOUSEHOLD CONSUMPTION NEEDS	
Cash	- primary uses for cash, timing of needs, uses and needs of men and women
Foods	- principal foods consumed, when are they in shortfall, which are gathered, bought, sold
Water	- nearest source of drinking and non-drinking water
Fuel	- major sources of fuel
Shelter & Construction	- major uses and sources for building materials
INFRASTRUCTURE	
Transport	- distance to all-weather road, tarmac road
Communications	- availability of phones, post
Human health	- availability of doctors, nurses, clinics, medicines
Legal services	- how conflicts are resolved, access to services
Cooperatives and organizations	- what types of exist and what services do they provide and to whom
Credit	- types of lenders in area, terms of loans, ease of access by type of borrower
Agricultural services	- extension services for crops, trees, livestock; access to all areas and types of households and individuals
Inputs	- availability and costs of necessary inputs to crops, trees and livestock
Marketing	- how commodities are marketed, size of markets, how payments are received and by whom
Processing and Storage	- possibilities for storage and/or processing of farm produce


CROPS
CROP 1
CROP 2
CROP 3
...
CROP n
ANIMALS
ANIMAL 1
ANIMAL 2
ANIMAL 3
...
ANIMAL n
TREES
TREE 1
TREE 2
TREE 3
...
TREE n
OTHER
PISCICULTURE
BEEKEEPING
...
OFF-FARM
BUSINESS
EMPLOYMENT
AID
...
OBJECTIVES
IMPORTANCE
STRATEGIES
INPUTS
MANAGEMENT
OUTPUTS
PERFORMANCE
PROBLEMS/ CONSTRAINTS
IMPROVEMENT

b) FARMING ENTERPRISES

The following pages present a possible checklist to diagnose and troubleshoot the various farming enterprises of the household in a matrix format. Components and other farming enterprises can be grouped in farming sub-systems that address objectives such as food selfsufficiency, cash generation, social obligations, etc.

Make a complete list of the crop, tree and animal components on the farm and rank each in order of importance (e.g. acreage) and priority (contribution to the objectives). For each enterprise, consider addressing the following issues through appropriate questions, observations, comments:

ISSUES	POSSIBLE QUESTIONS, OBSERVATIONS, COMMENTS
OBJECTIVES	• overall and specific farming objectives of the household in terms of: – food production (crops, animals, trees, other) – cash generation (savings, investment) – shelter – energy – raw materials – security (urgent cash needs) – other • main objectives of each identified enterprise
IMPORTANCE	• farmer priorities among these objectives
STRATEGIES	• strategies used by the farming household to achieve these objectives, enterprises used to achieve objectives
INPUTS	• quantities and costs of inputs needed to implement these strategies (seeds, organic/inorganic fertilizer. pesticides, labour, equipment, tools,...). Access to and control over inputs by gender
MANAGEMENT	• management practices involved
OUTPUTS	• nature and quantities of the main outputs and by products; rank their relative importance and implications for the farm (e.g. cash); amount of output surplus or deficit. Benefits received by gender.

PERFORMANCE	- looking at the input/output ratio and management requirements, judge the performance of the production system based upon experience and acceptable standards for the community (see community characterization information)
PROBLEMS/ CONSTRAINTS	- looking at performance and expectations (community characterization information) list the major bio-physical (soils, water, inputs, pests and diseases. weeds...) and social-economic (labour, land, cash, marketing, services...) problems and constraints identified by the farmer and by the team. Prioritise and explain differences between farmer and team lists.
IMPROVEMENT	- identify and rank interventions to improve the systems (both non-agroforestry and agroforestry) in terms of adoptability, impact (biophysical and socioeconomic) and sustainability

2.2 DIAGRAMS

Definition

- A diagram is any simple model which presents information in an easily understandable visual form.

Purpose

- To facilitate the collection and understanding of data

Types

- Possible diagrams include:
  - Space (maps, transects)
  - Time (seasonal calendar, historical maps)
  - Relations (systems diagram, conceptual diagrams)
  - Decisions (decision tree)

Characteristics

- simplifies complex information
  analytical
  facilitates communication
  stimulates discussion
  participatory
  aim at consensus

Example

- the following pages give some useful hints and examples for selected diagrams

2.2.1 MAPS

Definition

- A drawing of a specific land area showing any of a variety of biophysical or socioeconomic phenomena

Purpose

- A map helps to identify important attributes of the land area and to understand interactions and relationships.

Types

- Useful maps that can be drawn include:
  - farm layout map
  - gender resource map
  - infrastructure (markets, roads,...)
  - natural resources (soils)
  - demography
  - village, etc

Characteristics

- Spatial maps are snapshots and will change over seasons or years
  Historical (or temporal) maps require elderly and knowledgeable respondents
  Must be a participatory exercise involving the respondents and the team

Example

- The following pages give some examples of useful maps which can be used in the training exercise.

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a) Farm layout map

Use

- A farm layout represents the various land uses and farming enterprises of the farm on a single map.

Useful hints

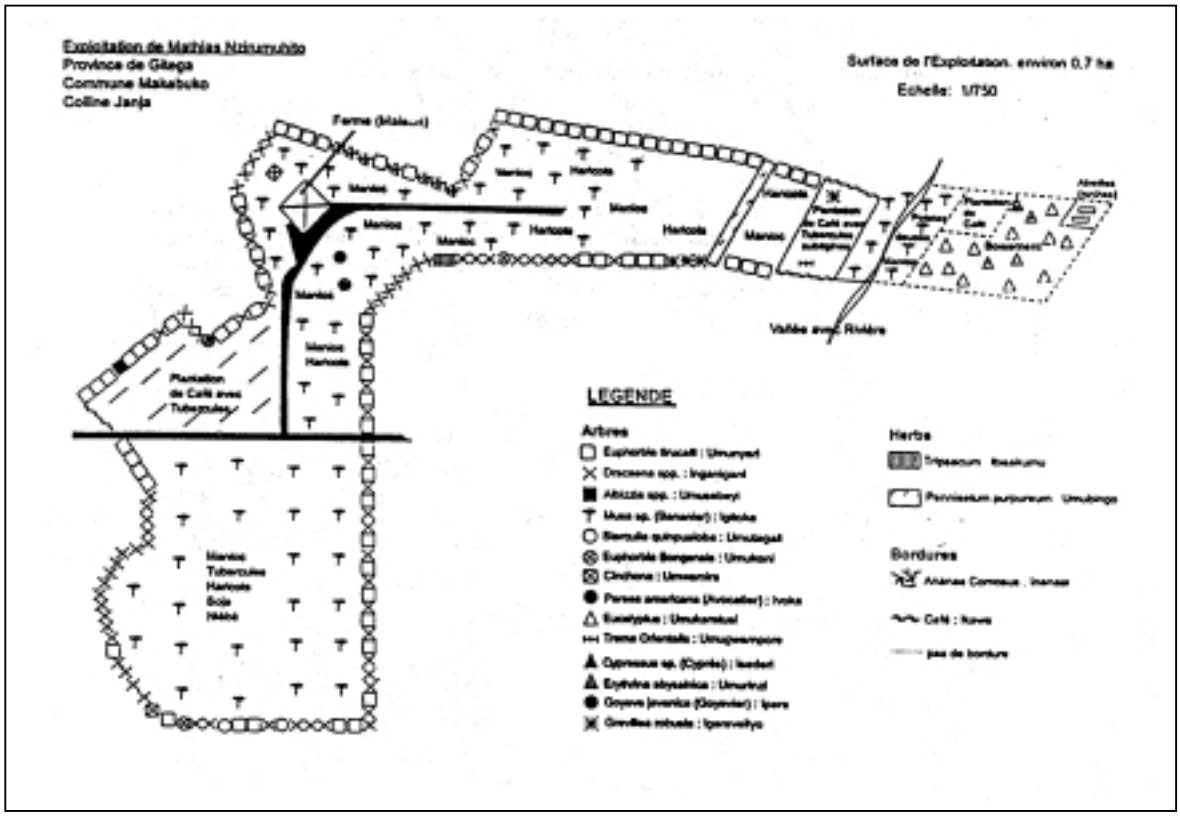
- Involve the farmer as much as possible (show and ask). However, it may take too much time in a training exercise to allow the farmer to actually draw maps.

  For a given component, management differences may need to be included
  Include orientation, scale, gradient, legend
  Include important information not directly related to the farming enterprise(s) (erosion control measures, water source(s), neighbouring trees..)

Example

- A farm layout map can be used to identify potential niches for multipurpose tree establishment

FARM LAYOUT MAP [1]
GITEGA, BURUNDI

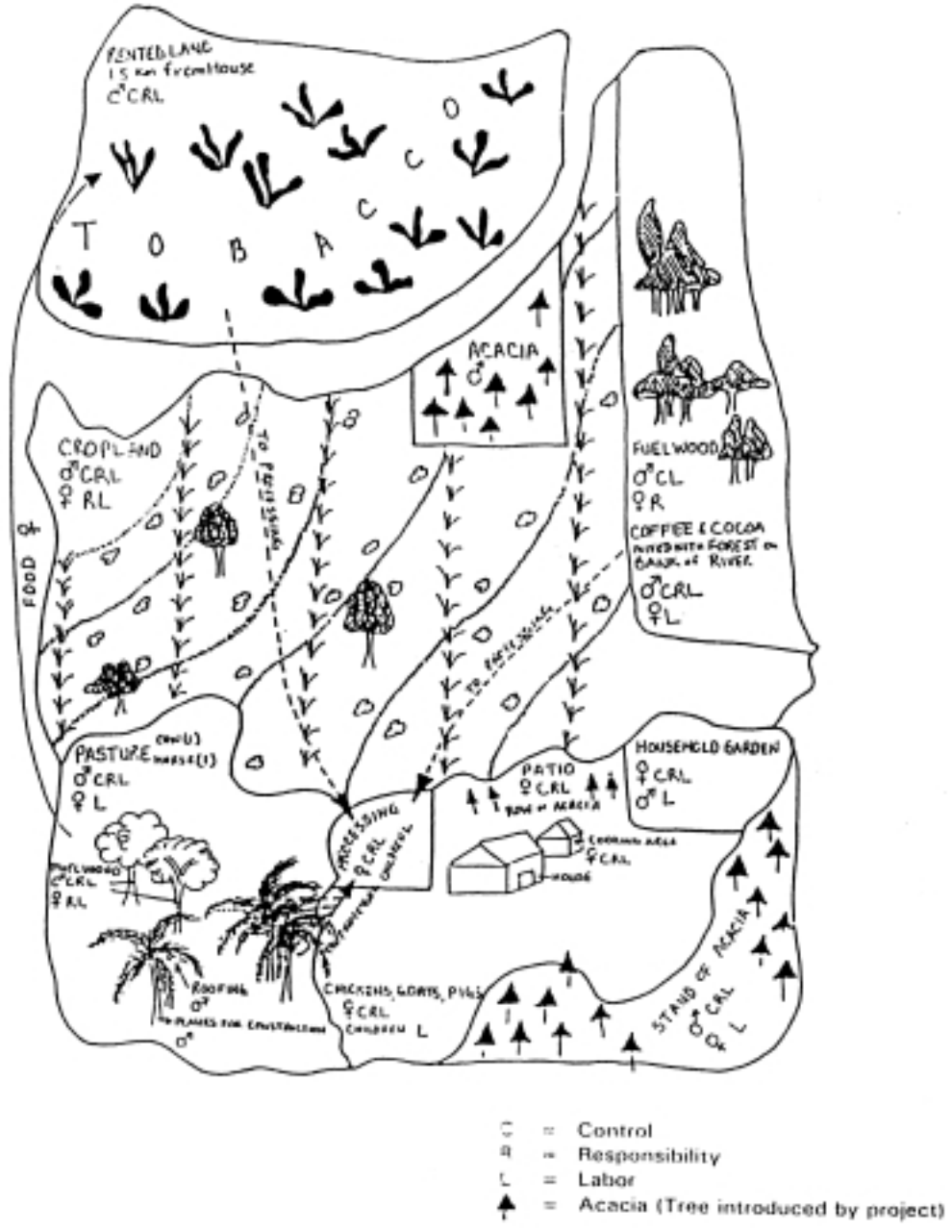


[1] Source: Guinand, Y., Hitimana, L., Franzel, S., and Akyeampong, E. *Complément de Diagnostic Agroforestier dans la Région Naturelle du Kirimiro*. AFRENA Report # 67, ICRAF, Nairobi, 1992

b) Gender resources map:

Uses	• Women and men make very different use of resources - even, in some cases, of a single species of tree. The gender resources map shows men, women, and children as distinct land user groups and distinguishes the intra-household division of control, responsibility, and labour over resources and related activities.
Useful hints	• Involve both males and females in the exercise. Include orientation, scale, gradient, legend Include important information related to the resources (how acquired, fertility, etc..)
Example	• A gender resources map can help researchers target questions and interventions to the appropriate household member by understanding the complementary and/or conflicting relationships between men, women, and children in regard to natural resources (adapted from Thomas-Slayter et al, 1993)

GENDER RESOURCES MAP[2]
Zambrana, Dominican Republic



[2] Source: Rocheleau and Ross, 1993

2.2.2 TRANSECT

Definition	• A transect is a spatial and/or temporal diagram of main landuse zones along a predetermined route and depicts the main features, resources, uses and problems of different zones.
Purpose	• Representing land quality and vegetation characteristics on a single diagram helps to identify major needs of target group on individual and possible interventions
Types	• Topography transect Historical transect (changes in landuse patterns over time) Village transect
Characteristics	• Can involve several farms and the community (village, surroundings) as well as an individual farming household Key informants may be needed, older knowledgeable respondents are preferred for historical transects
Example	• The following pages give some examples of useful transects which can be used in the training exercise.

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a) Spatial topographical transect

Uses

- A spatial transect provides researchers with a current view of existing resources, vegetation, and other important characteristics (e.g. soil erosion problems) across land use zones

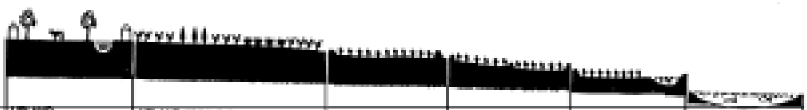
Useful hints

- Establish a representative route for the area to be covered by the transect
  Assign tasks to individual team members
  Walk the transect with knowledgeable respondents
  Note contrasts and changes and verify diagram with respondents

Example

- A transect walk can be used to identity potential niches for multipurpose trees and agroforestry systems.

TRANSECT[3]
BAVARDI AREA, BIHAR, EAST INDIA



LAND TYPE	UPLAND ([illegible])	UPLAND ([illegible])	MIDLAND (CHAURA)	LOWLAND (CHAPA DON)	LOWLAND (GARHA DON)	RIVER
SOIL	Gravelly coarse sandy loam (Gurgar)	Coarse sandy loam ([illegible])	Sandy loam ([illegible])	Loam ([illegible])	Silty clay loam ([illegible])	
WATER RESOURCES	Wells, Hand pump Ponds	Wells		[illegible]		
CROPS VEGETABLES	Vegetables maize	Rice arhar, maize, ragi, black gram, cowpea, gundli vegetables (potatoes, radish, tomato, okra) Wheat, vegetables in rabi season	Rice, Wheat Vegetables	Rice, vegetables	Rice	
TREES	Mango, jackfruit, [illegible] papaya, bamboo, [illegible]					
ANIMALS FISH	Cow, goats, sheep, poultry, ducks, pigs, fish, honeybee, buffalo	Cut and carry grasses Grazing : Grasses	Cut and carry Grazing in rabi season	Cut and carry grass Grazing in rabi season	Fish	Fish
PROBLEMS	Shortage of fodder Insufficient irrigation Disease & pest in horticulture & vegetable crops Disease in animals esp. in cattles, poultry Lack of input delivery system, fertilizer and seeds	Drought and lack of irrigation Low soil fertility Gandhi bug in rice Stemborer and other insects in maize Soil erosion Insufficient supply of seeds Soil acidity	Lack of irrigation Rice hispa Low soil fertility Soil erosion Stem borer in rice Lack of good seeds Assured fertilizer supply	Lack of irrigation for rabi crop Weeds Lack of input delivery Rice pests	Lack of assured supply of good seeds & fertilizers Flooding	

[3] Source: Training Resource Book for Farming Systems Diagnosis. International Rice Research Institute, Manila, 1990.

b) Historical land use transect

Uses

- An historical transect demonstrates the evolution of resource access and land use change within a specified geographical area. It can be used to understand how land use patterns have changed in response to population growth and other factors

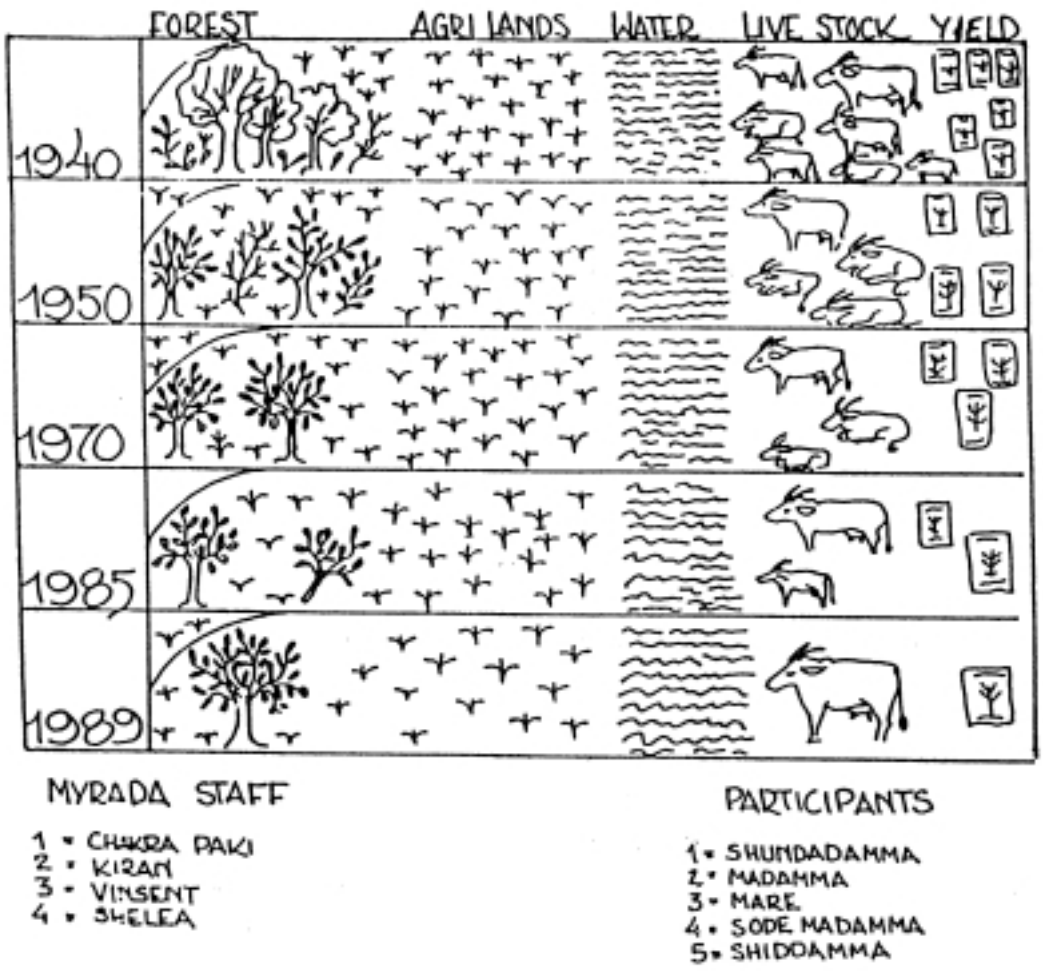
Useful hints

- Establish a representative route for the area to be covered by the transect
  Assign tasks to individual team members
  Walk the transect with knowledgeable respondents
  Note contrasts and changes and verify diagram with respondents
  Historical transects require elderly and knowledgeable respondents

Example

- An historical transect can be used to understand changes in tree resource availability and quality over time.

HISTORICAL TRANSECT MAP[4]
ARDANARYPURA VILLAGE, INDIA



[4] Source: Forests, Trees and People, Newsletter No. 15/26

2.2.3 CALENDARS

Definition

- A calendar is a diagram that registers a sequence of events over a certain time period.

Purpose

- To capture information on timing of activities or flows of resources in order to determine temporal opportunities or constraints

Types

- Several types of calendars can be used to illustrate the sequence of farming events:
  - Farming enterprises
  - Food availability
  - Livestock feed
  - Seasonal activity by gender and age
  - Cash flow

Characteristics

- The time period is divided into smaller units, relevant to the event under consideration (e.g. seasons, months, days)
  A calendar often does not provide quantitative data on an event
  Farmers will have a different notion of time (e.g. beginning of the rainy season, harvesting time, planting time,). Use local terminology

Example

- The following pages give some useful hints and examples on several types of calendars that can be used during this exercise.

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a) Enterprises

Use

- An enterprise calendar registers the main farming and household enterprises throughout a given time cycle (e.g. calendar year) and includes time related information relevant to the problem under consideration (problems, bottlenecks, opportunities).

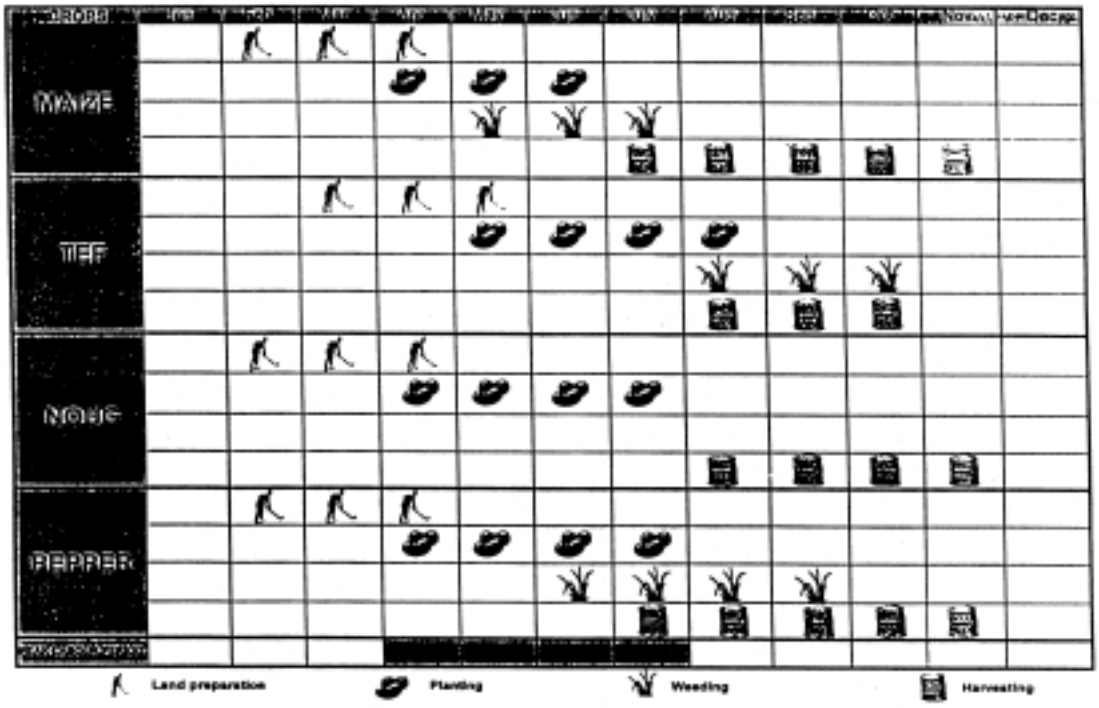
Useful hints

- Include crop sequences from planting to harvesting, tree and livestock management
  Include off-farm (employment, schooling, holidays,...) and non-farming (house repairs, social events) activities
  Superimpose relevant information on the problem being diagnosed (e.g. Iabour, marketing, income and expenditure, climate, pests and diseases,...)
  The use of the "Bao" game may help identify and rank events and enterprises throughout the time cycle (rows represent activities, columns represent months)

Example

- Enterprise calendars will reveal time related problems (competition) and opportunities in a farming system (e.g. labour constraints to managing an agroforestry technology, peak production periods and marketing problems)

ENTERPRISE CALENDAR[5]
BAKO AREA, WESTERN ETHIOPIA



[5] Source: Legesse Dadi, Gemeschu Gedeno, Tesfaye Kumsa and Getahun Degu. "The Farming System of the Bako Area" in Franzel, S. and Van Houten, H, (eds) Research with Farmers: Lessons from Ethiopia. CAB International, Oxford 1992

b) Food availability

Use

- A food availability calendar registers the availability (surplus, shortage) of principal foods at different time of the year.

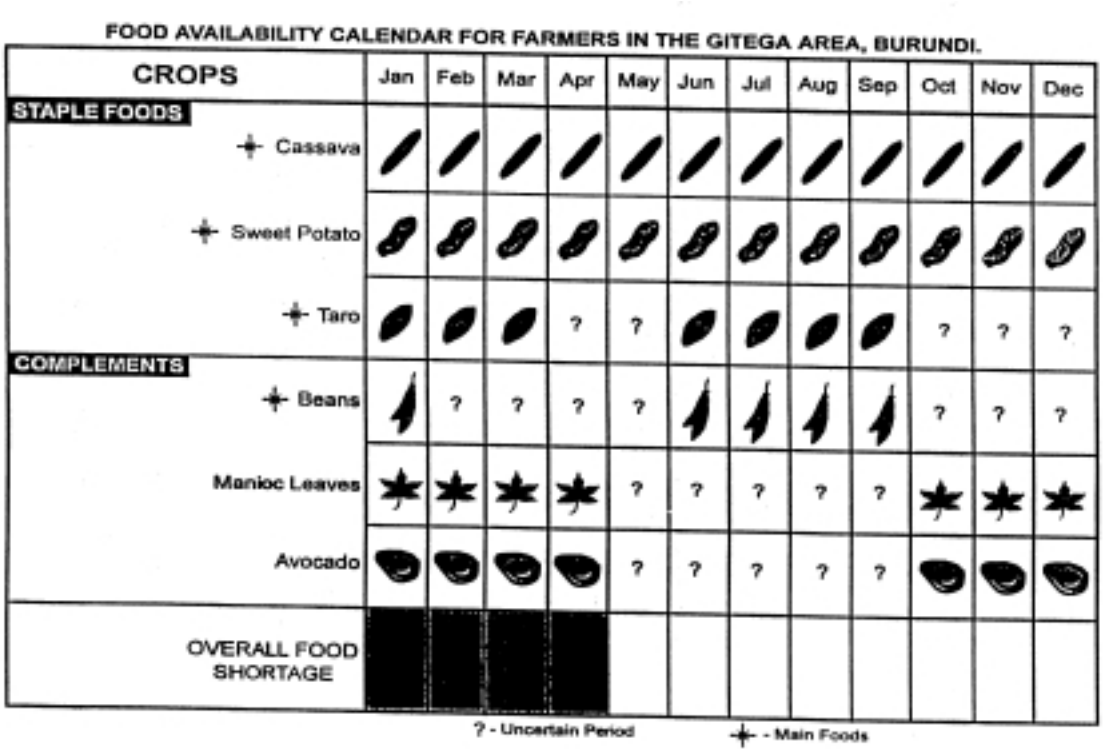
Useful hints

- Distinguish between staple foods and complements, preferred foods and substitutes
  Identify the main food shortage period(s)
  Ask how the farming household deals with food shortages
  Use the "Bao" game to rank the importance of the problem throughout the year (rows are foods, columns are months, two seeds means food is available, one seed means uncertain, no seed means unavailable)
  Discussing food shortages is often very sensitive! Verify responses with key informants.
  Make a comparison with the food situation in your own country to lighten the discussion

Example

- Identifying seasonal food shortages will indicate a need for food alternatives (purchased foods, other crops) and/or supply improvement (storage, processing, early and late maturing varieties, ...)

FOOD AVAILABILITY CALENDAR[6]
GITEGA AREA, BURUNDI



[6] Source: Guinand et al, 1992. Note: The calendar does not reflect the quantities of food available for individual items. An overall indicator of quantity is given in the last row.

c) Livestock feed availability

Use

- A livestock feed calendar registers the availability of principal feeds at different times of the year.

Useful hints

- Identify all possible livestock feeds available on the farm and in the area (grazing land, crop residues, fodder crops and trees, concentrates)
  When are they in short supply and how does the farming household deal with such shortage
  Differentiate between species (cattle, sheep, goats,...) and types (oxen, dairy cow, calf,...)
  Ask about periods for births, weaning, sales, migration,...
  Use the "Bao" game as for the food availability calendar

Example

- A livestock feed availability calendar will indicate the need for alternative (concentrates, tree fodder) and/or improved feed supply (storage, ensilage) sources.

LIVESTOCK FEEDING CALENDAR[7]
VIHIGA AREA, WESTERN KENYA

NUMBER OF FARMERS FEEDING AT DIFFERENT TIMES OF YEAR														
FEED SOURCE	TOTAL FARMERS FEEDING	ALL YEAR	J	F	M	A	M	J	J	A	S	O	N	D
Grazing own farm	24	24		X	X	X								
Commonland	19	9	3	2	2	1	1	1	1					
Other farm	16	7	4	2	1	1	1	1	1					
Maize stalk green	23		2			1	11	16	19	12	1	1	3	
Maize stalk dry	20		7	3						11	12	9	3	
Maize leaves	6					1	1	2	2	2	2			
Maize tops	8		1	1	1				5	6	2			
Banana leaves & stems	10		9	5	4	1								
Sugarcane tops	12	2	4	3	4	2	2	1	1			1	1	
Salt	7	O	C	C	A	S	I	O	N	A	L			
xxx – Period of year when grass is least available														

[7] Source: Wangia, S.M.M. *Dairy Farmer Survey Report of Vihiga-Hamisi-Ikolomani Divisions, Kakamega District, Kenya*. Ministry of Agriculture, Western Agricultural Research Station, Kakamega, 1980

d) Seasonal activity by gender and age

Uses

- A seasonal activity calendar by gender and age shows the various activities undertaken by the different members of the household and may also indicate the intensity of their effort.

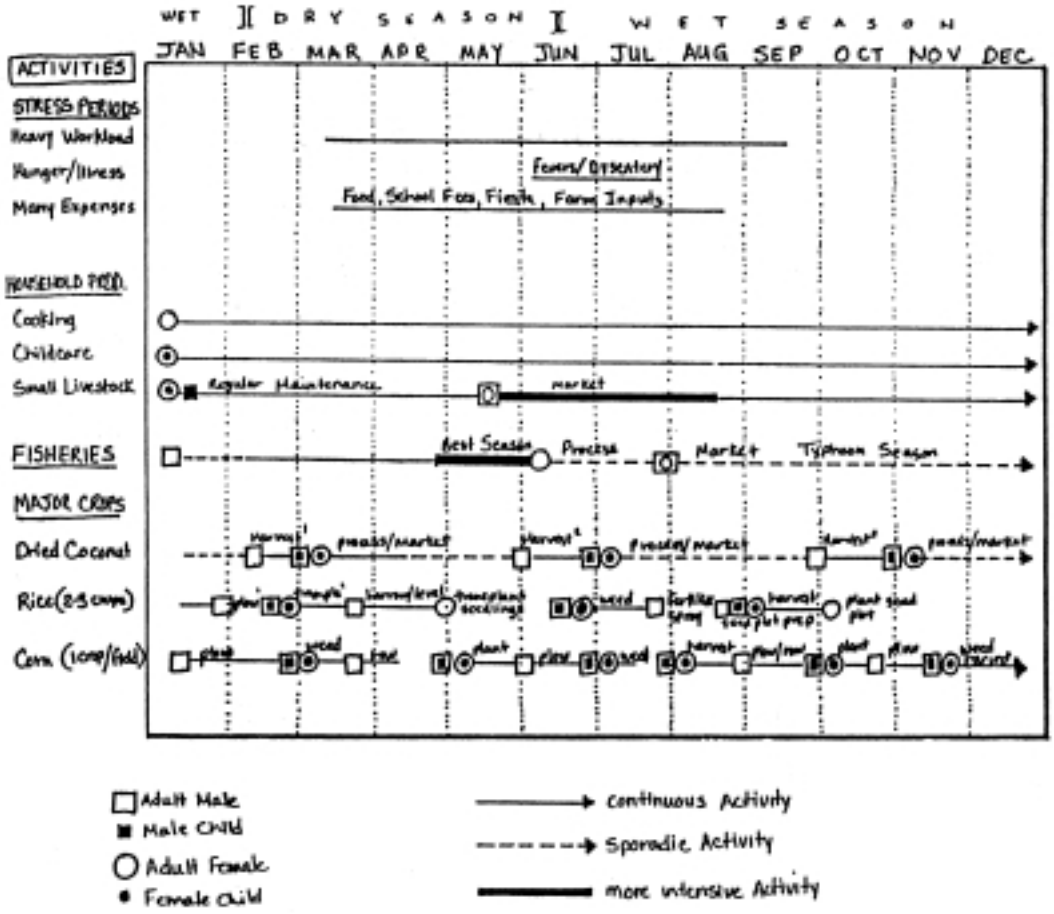
Useful hints

- Have respondents indicate all the major activities requiring labour effort listing minor activities as well can lead to unmanageable calendars)
  Include off-farm activities May superimpose specific tasks required for each activity and use of hired labour

Example

- The seasonal activity calendar by gender and age can identify peak periods for each member of the household during which little or no time would be available for a new intervention (if existing activities are maintained).

SEASONAL CALENDAR[8]
SIQUIJOR ISLAND, PHILIPPINES



[8] Source: Shields and Thomas Slayter, 1993

2.2.4 LABOUR AND RESOURCES CHARTS

Definition

- Charts which identify the control, access, and/or activities of household members with respect to resources, land areas, inputs, or outputs.

Purpose

- To understand differences in objectives, resource use and decision making between various household members in order to design interventions with higher likelihoods of success.

Types

- The following charts can be created to depict snapshots or historical trends:
  - Gender and age division of labour
  - Gender access and control of resources
  - Input decision making
  - Output users
  - Benefit flows

Characteristics

- The charts will normally be qualitative in nature
  Can be broad to cover whole farming systems or focussed on particular resources or commodities

Examples

- The following pages give examples of useful charts which can be used in the training exercise.

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a) Gender and age division of labour

Uses

- A gender and age division of activity diagram identifies the various activities undertaken by male and female adults and children.

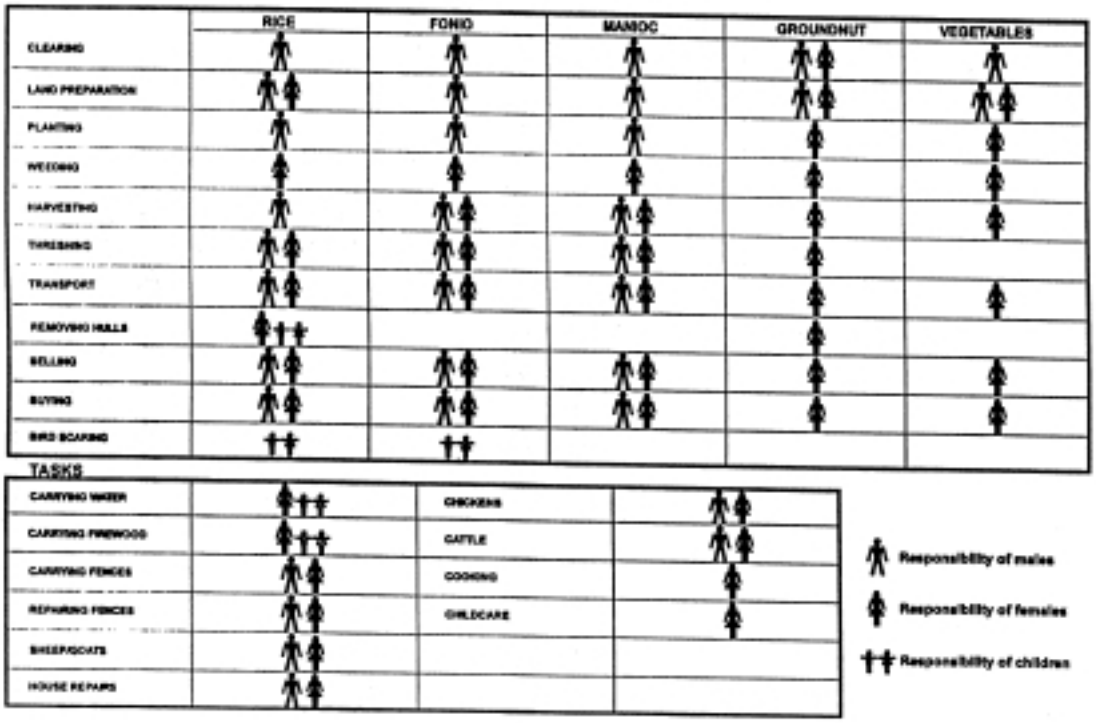
Useful hints

- Distinguish between farming household and hired labour
  Identify the division of labour for each farming enterprise and activity as well as other non farm activities (e.g. child care, marketing).
  Collect information from men and women and respondents of different ages
  Use the "Bao" game to identify division of labour (rows are activities, columns are male, female, children)

Example

- A gender division of labour diagram may indicate what problems or opportunities exist to introduce an agroforestry technology. Men may dominate cash generating farming enterprises, women may be interested in fuelwood technologies or food production.

GENDER AND AGE DIVISION OF ACTIVITY DIAGRAM[9]
GNALIA, GUINEA



[9] Source: Farming Systems Support Project. Diagnosis in Farming Systems Research and Extension. FSR/E Training Manual, Vol. 1. Gainsville, USA, 1987.

b) Benefit analysis flows chart

Uses

- The benefit analysis flow chart is used after information on activities (e.g. seasonal activity calendar) and resources (e.g. gender resources map) are collected. The benefit analysis flow chart shows information about who has access to the products of a household's labour and who decides how products should be used. It helps in the understanding of how decisions are made over the use and disposal of benefits (e.g. outputs) by various household members. [7]

Useful hints

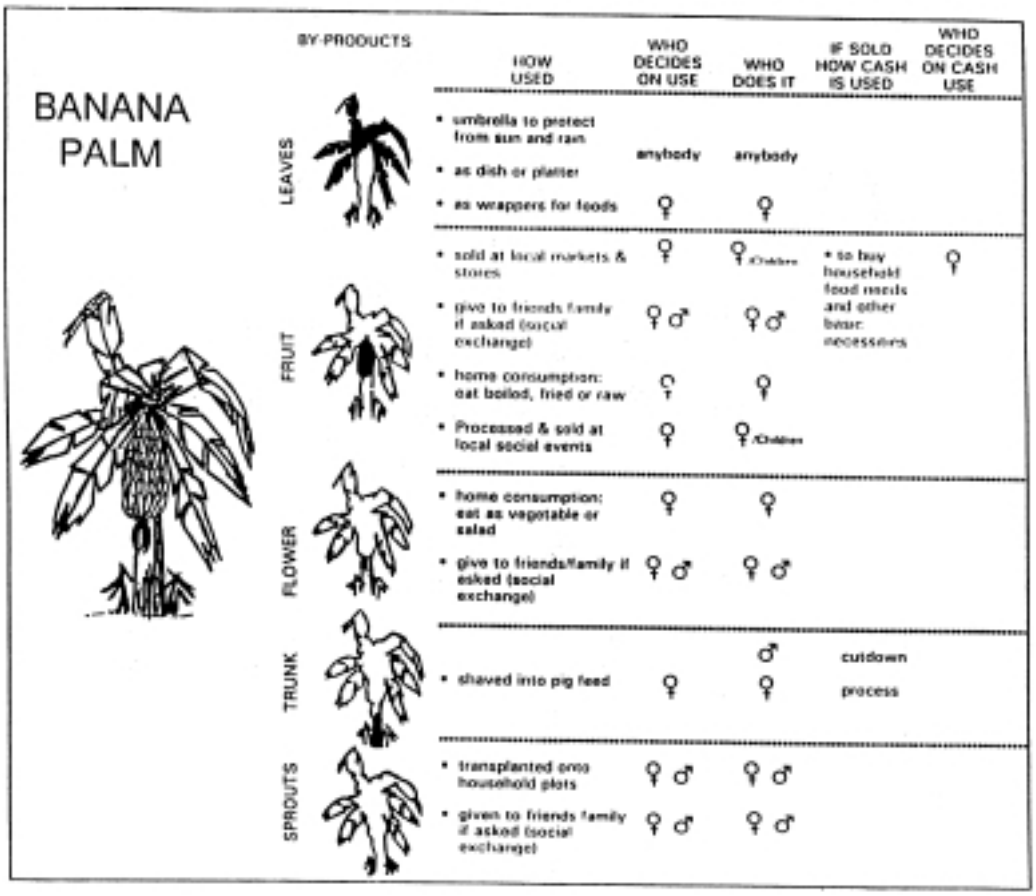
- Identify precise uses for the selected outputs with the aid of respondents
  Collect information from both men and women from respondents of different ages
  Collecting this type of information may be sensitive

Example

- The benefit analysis flow chart can help to understand how decision making varies according to type of output as well as how it is used.

[7] Adapted from 'Thomas-Slayter et al, 1993.

BENEFITS ANALYSIS FLOW CHART[10]
AGBANGA, LEYTE, PHILIPPINES



[10] Source: Buenavista and Flora, 1993.

2.2.5. CONCEPTUAL DIAGRAMS

Definition
- A drawing depicting the idea of farming systems in general. They include activities that take place in any season and any location. [8]

Purpose
- Conceptual diagrams capture the full range of household activities, highlight complexities of the system, and challenge preconceived ideas.

Types
- Farming system model
  - Household agroecological system
  - Cause and effect diagram

Characteristics
- Can be depicted in textual form or in symbols.
  Is qualitative not quantitative
  Should consider links with other systems

Example
- The following pages give some examples of useful conceptual diagrams which can be used in the training exercise.

[8] Adapted from Feldstein and Jiggins, 1994

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a) Farming systems

Uses

- A complete or partial farming systems diagram can help to identify linkages and explain certain management practices that may not be evident at first sight.

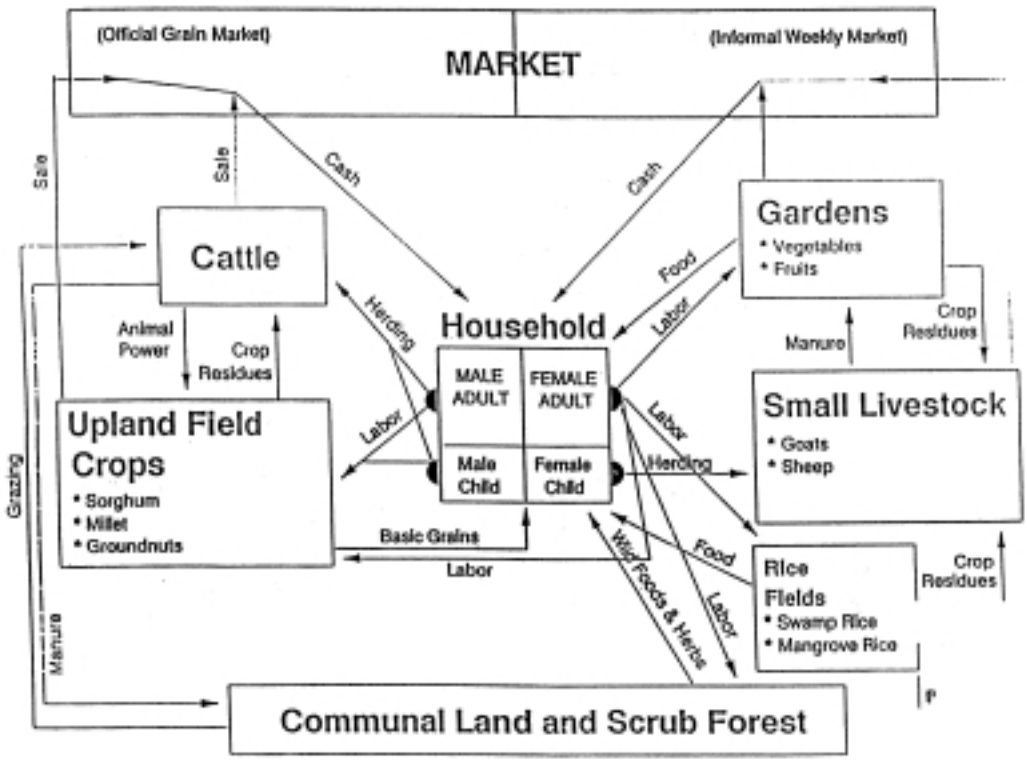
Useful hints

- Identify the various crop, animal and tree production systems as well as off-farm enterprises
  Identify linkages and differentiate between strong and weak ones (thick arrows, thin or broken arrows)
  Involve the farmer or get feedback as the team develops the diagram

Example

- A farming systems diagram shows the linkages between different resources and activities and users of the resources.

MODEL OF A HYPOTHETICAL HOUSEHOLD PRODUCTION SYSTEM IN WEST AFRICA[11]



[11] Source: Susan Poats, Date unknown.

b) Conceptual diagram of a household agroecological system

Uses

- A conceptual diagram which captures the full range of household activities allows for the explanation of the complex relationships and different interests of household members. Interests may vary by age, gender, and other characteristics.

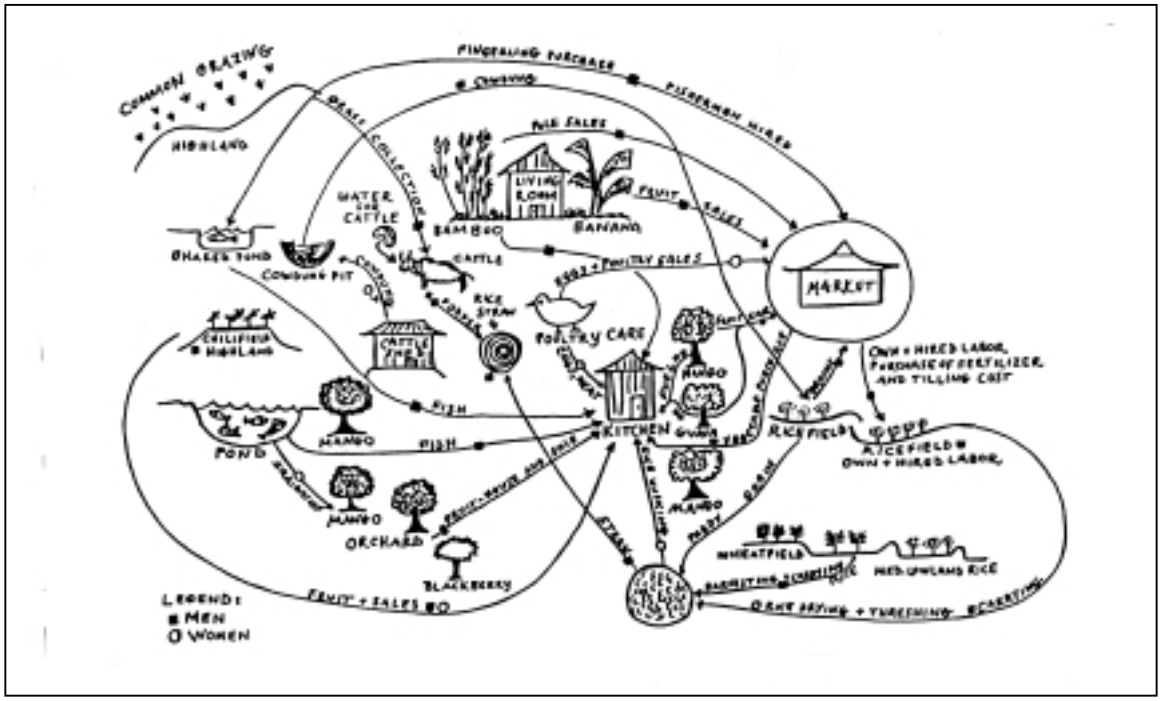
Useful hints

- Identify main activities and relationships
  Walk with women and men throughout the farm and involve them as much as possible in the sketch
  Clearly distinguish between enterprises and ecosystems
  Use symbols to depict male and female activities

Example

- The household agroecological system diagram shows the relationships between enterprises and resources both on and off-farm.

CONCEPTUAL DIAGRAM OF A HOUSEHOLD AGROECOLOGICAL SYSTEM[12]



[12] Redrawn from Lightfoot et al., Household Agroecosystems and Rural Resource Management

c) Cause and effect

Uses

- A cause and effect diagram highlights the multi-cause nature of many problems and thus facilitates optimal intervention design.

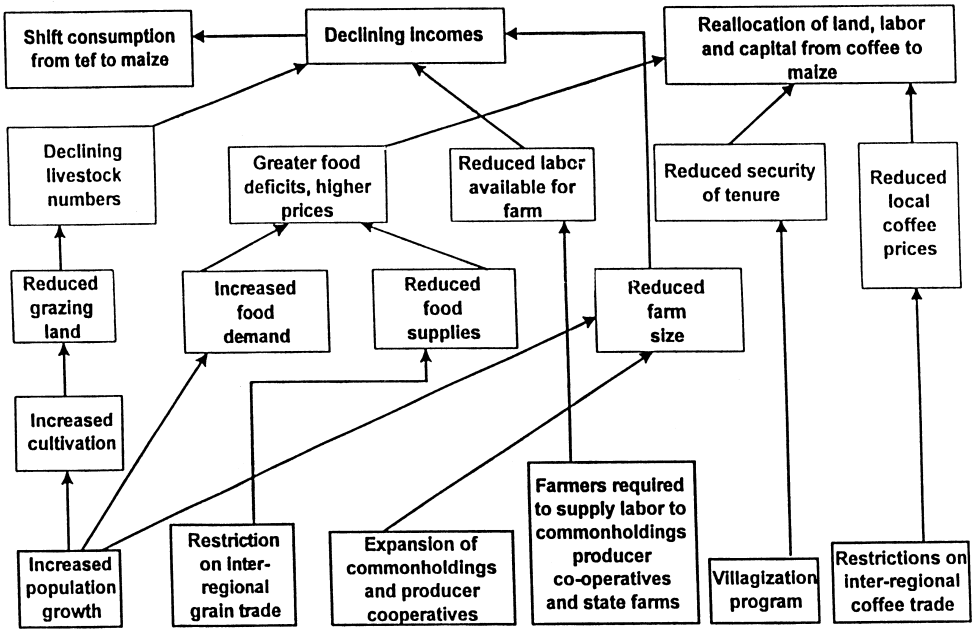
Useful hints

- It is often better to focus on a specific problem and its most important interactions (e.g. fodder shortage)
  Specify and quantify the problem and its variables as much as possible (e.g. poor soil fertility is too vague, acidic soils - pH < 4.5 is more meaningful)
  Where possible, let the farmer draw the diagram or ask for feedback while developing it.

Example

- The explanation of why farmers are shifting resources from coffee to maize can have a multitude of causes

CAUSE AND EFFECT DIAGRAM TO EXPLAIN SHIFT FROM COFFEE TO MAIZE PRODUCTION[13] JIMA AREA, WESTERN ETHIOPIA



[13] Source: Seyoum Kassahun, Hailu Tafesse and S. Franzel. "Prospects for Improving Coffee-based Farming Systems" in Franzel, S and Van Houten, H. (eds). *Research with Farmers: Lessons from Ethiopia*. CAB International, Oxford, 1992.

2.3. RANKING

Definition

- Rating or scoring means evaluating the performance of alternatives along a scale, e.g., from excellent to poor.
- Ranking, on the other hand, means pricing alternatives in order, e.g., best, second best, third best. In matrix rating (ranking), the alternatives and ratings (rankings) on different criteria are arranged in a table (Table 1)

Purpose

- To obtain farmers' evaluations of alternatives and the reasons for their evaluations

Types

- The rating method used during the field exercise focuses on matrix rating through the use of the "Bao" game (Figure 1).

Characteristics

- Analytical. Complements semi—structured interviewing by focusing questions.

  Useful for getting quantitative data on farmers' preferences, subject to tests of statistical inference (Table 1)

Useful hints

- Use local names for whatever is to be rated

  Find out from farmers the most important criteria they use in comparing trees. This can be done by touring the farm and asking farmers what they like and dislike about each species. Criteria usually include end products (e.g. timber quality of different trees) and growth characteristics (e.g., coppicibility). Don't use your own criteria.
  Use local games (e.g. "Bao" game) for the rating exercise
  Probe and document the reasons for ratings
  Be aware of respondent differences (e.g. gender)

Example

- Matrix ranking ("Bao" game) can be used to understand farmers' preferences among tree species in existing agroforestry practices or among alternative species in onfarm trials. The information is useful for planning agroforestry research and, in particular, for setting priorities among trees for a given technology or for tree improvement programmes.

Figure 1. *The "bao" game in use to rate the characteristics of trees: 5 seeds in a packet is excellent, 1 is poor*[14]

[14] Source: Franzel, S. *Use of the Bao Game for Obtaining Farmer's Evaluations of Species*. ICRAF, Nairobi, 1993. Artist: Sylla Pahladsingh.

Table 1. *Farmers' mean ratings, using the "bao" game, of selected species across criteria considered important to them (standard deviations in parenthesis)*

	Management & Growth		Use for Timber			Use for firewood	
Species/Ratings	**Compatibility with crops**	**Speed of growth**	**Resistance to insects**	**Wood Appearance**	**Straightness**	**Quick in drying**	**Durabilty of fire**
Maesopsis eminii	3.8	4.7	4.2	4.8	4.2	3.1	3.5
Cedrela serrata	4.6	4.3	4.5	5.0	5.0	-	-
Grevillea robusta	4.9	4.6	2.5	2.6	4.1	3.2	2.8
Casuarina cunninghamlana	1.0	2.2	4.2	4.1	3.9	3.0	3.8
Markhamia lutea	3.7	1.9	4.5	4.3	1.8	2.3	4.2
Eucalyptus sp.	1.1	4.3	4.0	2.5	3.6	4.7	5.0
Cupressus lusitanica	1.0	3.2	4.5	4.6	3.9	4.6	3.5
Albizia chinensis	4.0	3.5	1.3	-	1.3	2.3	3.3

Twenty five persons were interviewed, the number rating a specific species on a particular criterion varies from 5 to 20. For some species certain criteria are irrelevant e.g., *C. serrata* is never used for firewood, and *A. chinensis* is never used for timber.

The rating of 1 to 5 refers to the score in number of seeds the farmers gave to a species on a particular criteria. A rating of 5 was considered excellent, a rating of 1, poor.

Primarily, *E. saligna*, *E. maideni*, and *E. camaldulensis*

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3. CHARACTERIZATION INFORMATION

3. CHARACTERIZATION INFORMATION[1]

3.1 Introduction

This section provides participants with some useful, often necessary information about the Mae Taeng area. The characterization data have a quantitative nature and are geographically referenced.

The quantitative data presented here were not collected as part of a systematic characterization exercise. Instead, the data were synthesized from several studies conducted in the area. As such, some data required for a satisfactory characterization exercise, are missing, while in other cases, the presented data may exceed the required "minimum data set". Within each topical section, several tables are presented among with, in some cases, a descriptive write-up.

A characterization exercise should be the starting point of diagnosis work. The exercise consists of both assembling existing secondary data as well as likely primary data collection. The information serves several important purposes:

First, it helps to identify sites in which to work, based upon data such as population density, rainfall, soil types, …

Second, an analysis of characterization data can help to narrow down topics for diagnostic work. For example, characterization will enable researchers to identify important crops on which to focus. This latter outcome can quickly be made with the aid of secondary information.

Third, later in the research process, the characterization information can help to understand the conditions, in which a given intervention has or has not worked. This is useful for extrapolating the results to other areas.

3.1.1 Location

Chiang Mai is the largest city in the north and the second largest city of Thailand, with a population of app. 150,000 people. The city is situated app. 700 km north of Bangkok in a valley that extends from the base of Suthep mountain to the Ping River. Chiang Mai's history goes back hundreds of years (Chiang Mai now has been a city for at least a total of 700 years). Over the past centuries, there was sporadic warfare for several generations. This might be one of the reasons that Chiang Mai was settled by several different ethnic groups who brought with them a variety of cultural heritages, traditions, as well as agricultural practices, so called agricultural systems. For instance, opium cultivation in the highland used to be a major activity for some of the minority groups but was slowly replaced by cash crops and eventually became more permanent agricultural systems.

The field site in Mae Taeng is app. 2 hours north-west of Chiang Mai and the groups will leave Sunday, March 14, after lunch. The following pages will give an overview of the area and the agricultural systems, followed by a summary of the prevailing forests.

[1] Compiled by: Dr. David Thomas, Dr. Horst Weyerhaeuser, Anantika Ratnumhin, Pornwilai Saipothong ICRAF/Chiang Mai

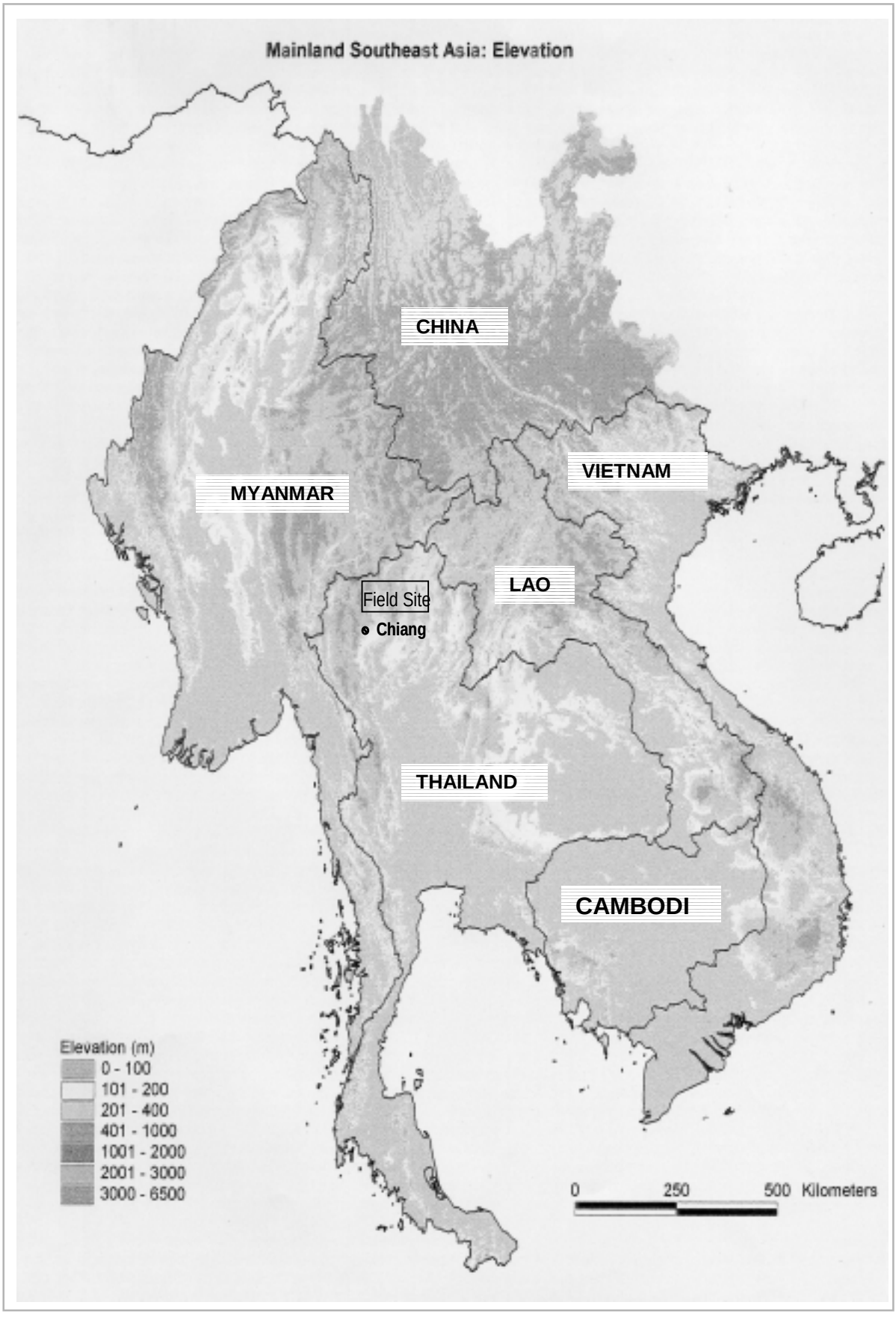


Figure 2: Regional Map of Southeast Asia; ***Source: World Resources Institute (WRI) and ICRAF, Chiang Mai***

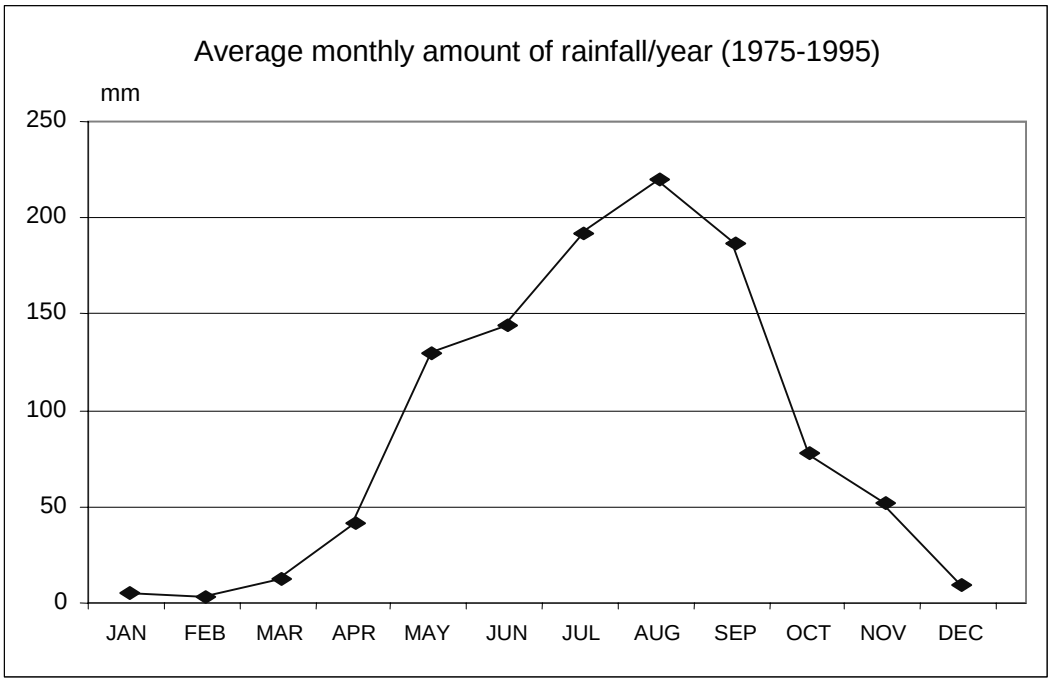
3.1.2 Climate

The northern provinces of Thailand, where the field site in Mae Taeng district of Chiang Mai province is part of, stretches along the Thai/Myanmar border in the west and north-west and in the north and north-east with Laos (Figure 2), and is greatly influenced by the monsoon climate. This climate can be characterised by 3 distinct seasons:

- the dry, cool season from November until January
- the dry and hot season from February until April
- and the warm and wet season between May and October

The average minimum and maximum daily temperature varies between 10° and 30°C in the dry and cool season, 14° and 35°C during the dry and hot season and 16° and 32°C in the warm and wet season. The north of Thailand receives between 810 mm and 1600 mm of rain annually. The climate is affected by a rainfall pattern as roughly 80% of the annual precipitation is provided during the rainy season (Figure 3 and Figure 4). The rest of the year receives only 20% with the so called "mango showers" in January and February and some cyclonic storms during the dry and hot season.

Figure 3: Monthly amount of Rainfall

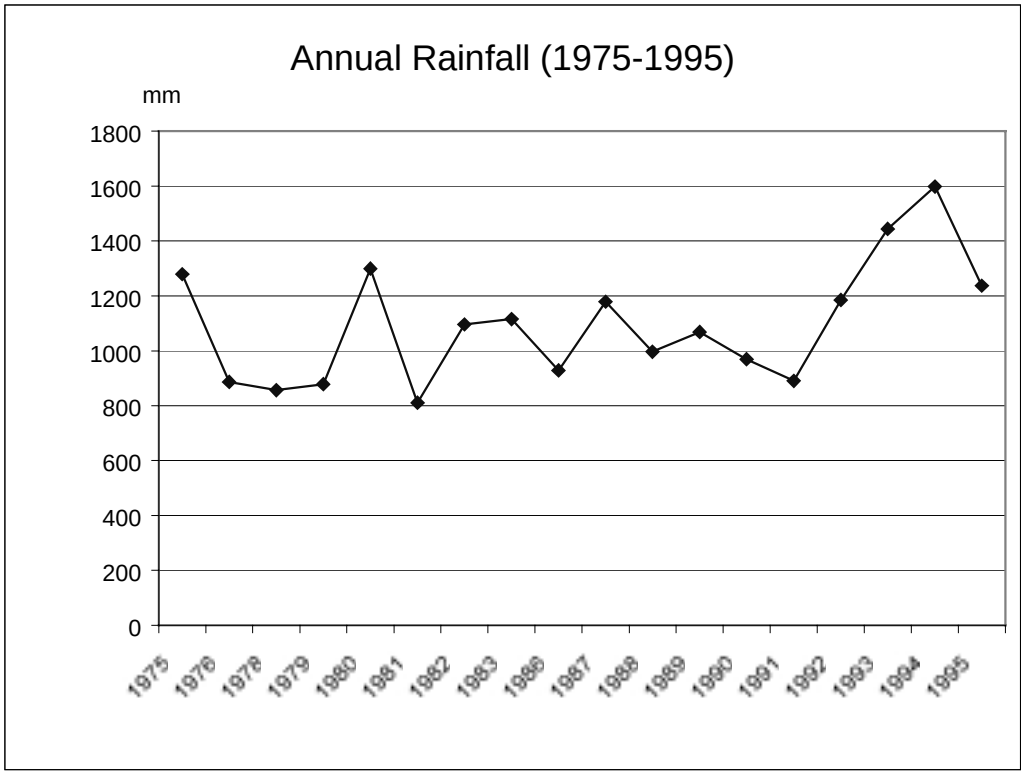


Source: Mae Taeng Station, Comp. Section Climatology Division, Meteorological Dept., Chiang Mai

The high variability of rainfall of 800 mm/year between the very dry year of 1981 (800 mm) and the very wet year of 1994 (1,600 mm) with sometimes devastating floods, is a common occurrence in the region (Figure 4).

The mean annual precipitation of 1,073 mm (1975-1996) in Mae Taeng might be slightly overestimated because of the unusual amount of rainfall in 1975, 80, 93 and 94. Occasionally heavy thunderstorms before, during and after the rainy season occasionally affect Thailand, resulting in massive downpour in a short period of time.

Figure 4: Annual amount of Rainfall



Source: Mae Taeng Station, Comp. Section Climatology Division, Meteorological Dept., Chiang Mai

In November 1988 the Royal Thai Meteorological Department reported a record **735 mm** (448 mm on Nov. 21 and 287 mm on Nov. 22) during 2 days of heavy rain, causing severe flooding and damages subsequently. The death of more than 350 people was also reported. In addition, this event was apparently related to logging and deforestation. The Thai government was urged to take a prompt action on logging ban. In the end, all logging concessions were revoked nation-wide in January 1989. Although heavy rainstorms (usually not as heavy as in 1988) increase the total amount of rainfall during a given year, but do not impact on the plant growth and production in general. The timing of the rainfall and overall distribution during the rainy season determines the regeneration establishment and development of the plant communities in the area. A late start of the rainy season as in 1995, 96 and 97, combined with an unfavourable distribution, even though the total amount of rainfall was close or even above average, might actually have a more negative impact on the plant growth as opposed to a fair distribution during the whole rainy season with less than the normal amount.

3.1.3 Vegetation – Agro-ecological Zones

Identifying major land use systems in Northern Thailand

Major generic land use systems in the Mae Taeng watershed correspond with ecological zones most easily distinguished by dominant ethnic groupings and altitudinal boundaries: Similar distinctions are found throughout the Mountainous Mainland Southeast Asia - MMSEA - region, and in Laos have traditionally been used to distinguish among ethnic

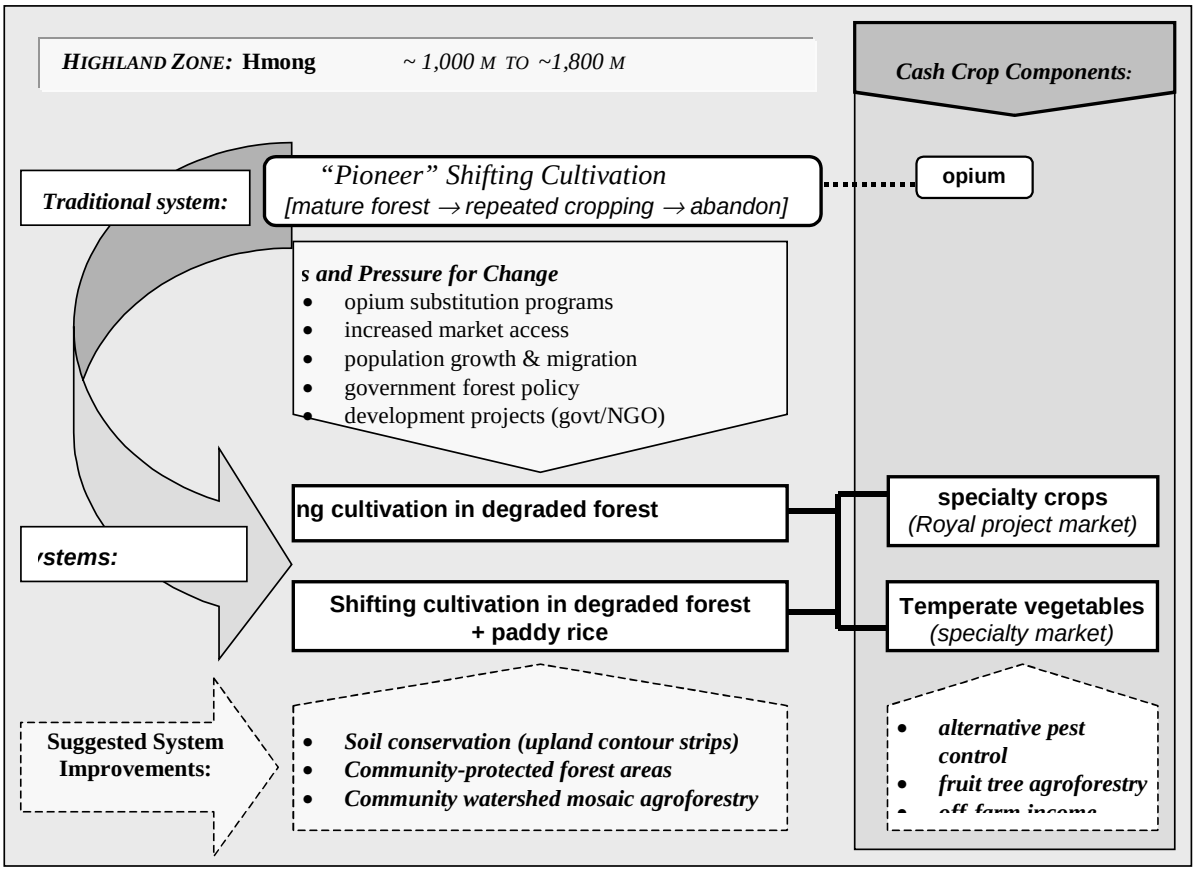
groups. Preliminary articulation of traditional, current and potential land use systems to be investigated in the Mae Taeng watershed are displayed diagrammatically in **Figure 5,** Figure 6 **and Figure 7**, according to three major eco-zones:

- In the ***highland zone***, ethnic H'mong communities are replacing their traditional pioneer shifting cultivation of maize, opium and in the recent past upland rice, with a system emphasizing intensive commercial vegetables on steep slopes. The associated loss of forest cover, increased erosion, water use and heavy pesticide use are major concerns of the downstream societies.

- ***Middle zone*** ethnic Karen land-use systems are derived from a traditional mixture of paddy rice cultivation in small pockets where terrain allows, supplemented by rotational shifting cultivation of upland rice employing a long forest fallow, and community-recognized permanent forest areas. Increased land pressure related to population growth and more restrictive policies have cut their forest fallow cycle to about 5 years or less, and brought conflict over access to locally protected forest areas. Responses include intensification of upland rice, with some areas are now using rice-soybean rotations in permanent upland fields, or introduction of highland-type vegetable production. While many lowlanders have come to respect the traditional ecological knowledge of these communities, some are worried about the watershed impact of current trends, and more strident lowland groups are also calling for their forced relocation.

- Land-use practices of ***lowland zone*** ethnic Northern Thai communities have traditionally centred on paddy rice cultivation and home gardens. In recent years commercial vegetables and soybeans are grown in paddies in rotation with rice. Some farmers have also begun rainy season soybean production in sloping upland fields they have pushed into forest reserves above their paddies. Implications for the rate of deforestation worry forestry and land development officials.

Figure 5: Hmong Farming System (Highland Zone)

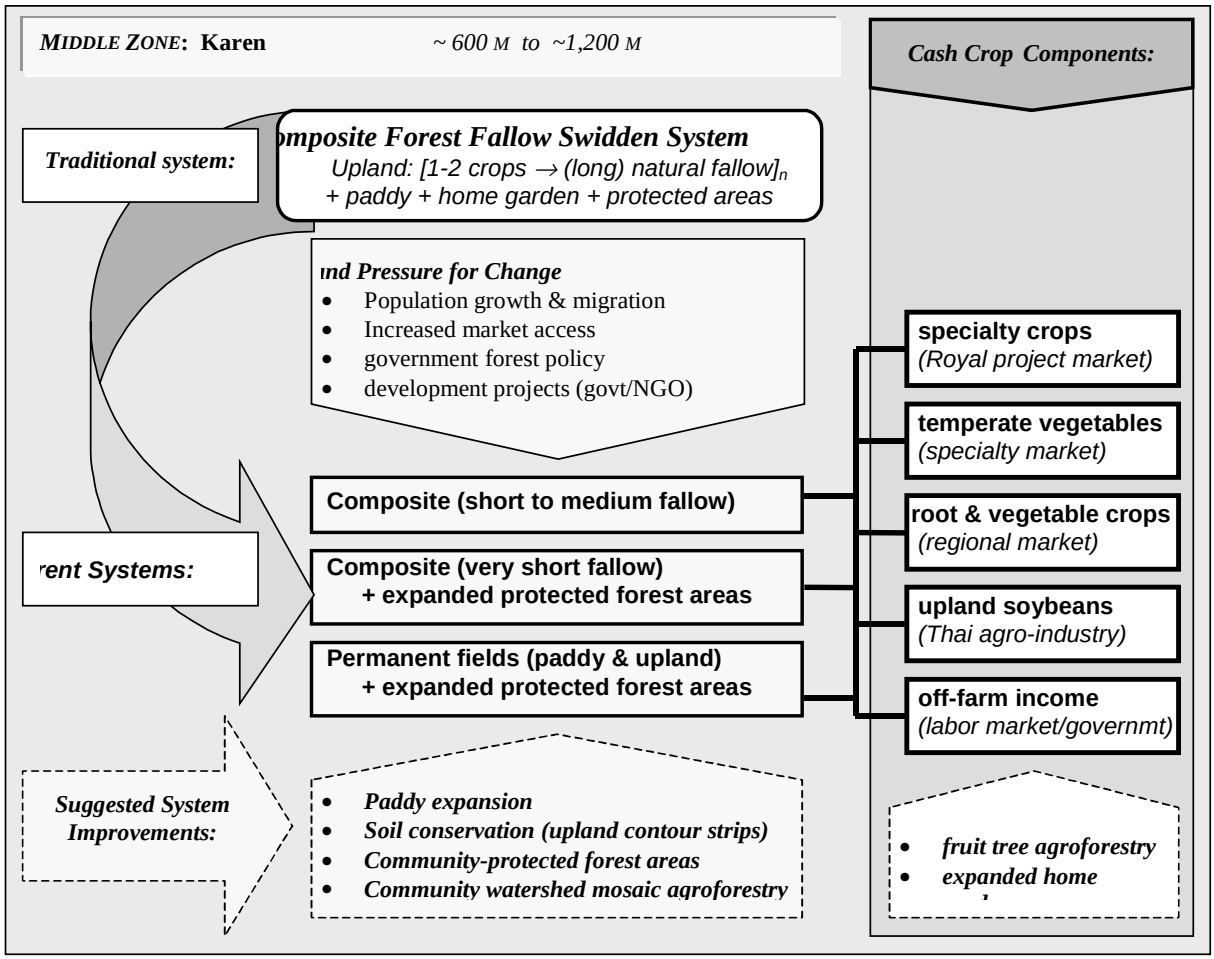


Source: ICRAF, Chiang Mai (David Thomas)

Since most upland fields in all three zones are located on lands that are officially reserved forest, very few have any form of legal title. Large areas are classified as protected watershed zones, and national parks and wildlife sanctuaries also occupy significant portions of the upper zones. Thus, deforestation and impact on watershed functions and biodiversity are major issues for land-use systems in northern Thailand, and provide much of the rationale used in increasing pressure to intensify agriculture in permanent fields. Expansion of intensive commercial agriculture has been facilitated in many areas by improving road access, education and services, in addition to development projects previously aimed primarily toward opium crop substitution and national security issues. Under more recent policies emphasizing environmental issues, emphasis is now on agricultural systems that include more trees and contour strips in permanent upland fields.

The overall proportions of cultivated land under various crops – as reported by the agricultural extension department and may thus may not be complete – are indicated in Figure 8. Although the total amount of area reported as planted to crops is small in relation to the total area of the watershed, crop figures do not include shifting cultivation fallow lands (which are not officially recognized) or areas where cultivation has been abandoned to imperata grasslands. Moreover, much of the area reported as forest is in various degrees of degradation.

Figure 6: Karen Farming System (Middle Zone)

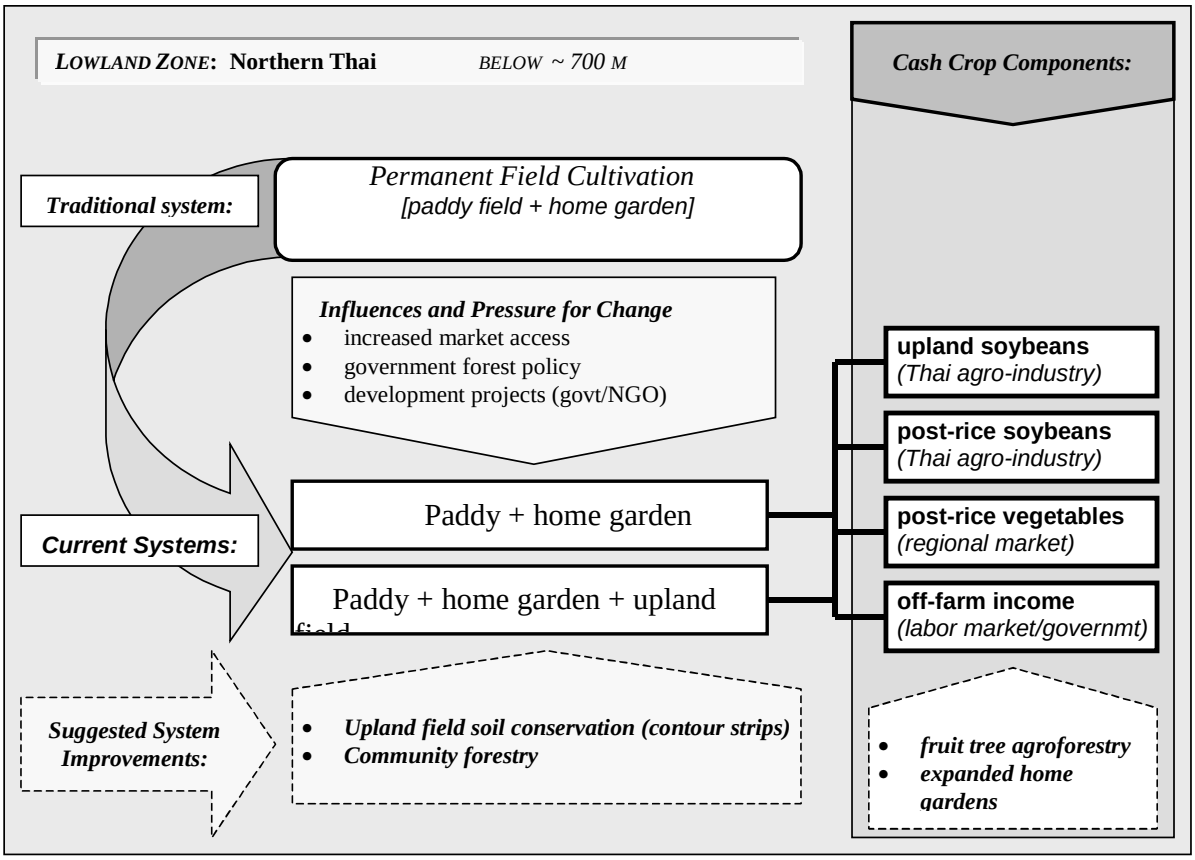


Source: ICRAF, Chiang Mai (David Thomas)

The agricultural statistics do capture at least relative proportions of some of the major agricultural crops in Mae Taeng. ***Rice*** is the major crop, and it is split between paddy and upland fields. Much of the paddy area is in the lowland zone. Since middle zone Karen, who make up a major portion of the population, prefer paddy over upland rice production, one can assume that sites available for paddy production in the middle zone, given available technology, are still far from adequate to meet their subsistence rice needs. Upland rice is, thus, primarily grown at middle zone sites where paddy land is insufficient, and at highland zone sites where sites for paddy are very scarce. Given the relatively large amount of land required for a traditional 10-year or so forest fallow rotation for upland rice in the middle zone, this has become a major issue for foresters and environmentalists concerned with deforestation. Thus, pressure from agencies and programs, especially in areas near national park boundaries, have at least gradually decreased the amount of area allocated to forest fallow fields in the middle zone. Compliance, of course, means that the overall fallow cycle must be shortened, resulting in farmer complaints about lower yields and higher labor inputs, especially for weeding. In some villages, this has eventually led to growing upland rice in fixed permanent fields, sometimes employing herbicides and fertilizer to compensate for lost fallow functions. Although some farmers report using these practices for more than 5 years, we know of no systematic study on the economic impact or the agronomic sustainability of this technology.

Field crop production is composed primarily of soybeans and maize. Soybean production in most areas of Thailand focuses primarily on cropping paddy fields after rice harvest, and in Mae Taeng such practices are used primarily in the lowland zone, and now in some middle zone Karen paddy areas near the lower zone boundary. Large proportions of soybeans are also grown during the rainy season using varieties that grow under rainfed conditions in upland fields. As soybeans are sold to buyers who supply Thai agro-industry, it is not surprising that upland soybean production began among Northern Thai farmers in the lowland zone. The pattern was for farmers to expand their paddy-based systems by pushing upland fields for soybeans into untenured forest lands above their paddies. Overall expansion of these practices was so rapid that significant areas of forest were cleared, raising substantial concern among foresters. A second component of upland soybean production, however, turns this issue around. As Karen farmers began experimenting with fixed field upland rice production, they soon found that splitting their upland fields into two parts enabled them to grow upland rice and upland soybeans in rotation, with perceived beneficial effects on upland rice productivity and cash income from soybeans. Thus, the other side of the upland soybean coin may be potentially forest-conserving. Again, however, we know of no systematic study of the economics, agronomic sustainability or environmental impact of upland soybean production.

Figure 7: Lowland Zone: Northern Thai (lowland Thai)



Source: ICRAF, Chiang Mai (David Thomas)

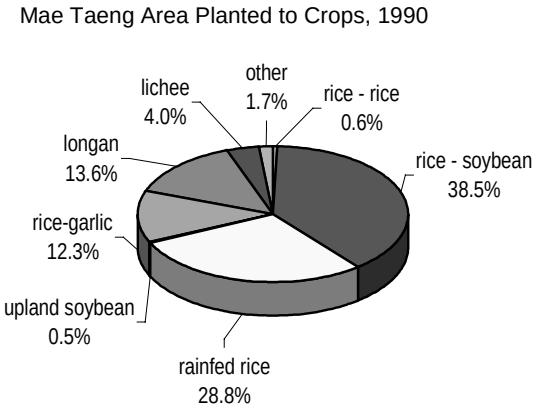
Annual vegetable and horticultural crops make up the third major component of agriculture. In the lowland zone, this consists largely of garlic, tobacco, onions and various other vegetables, usually grown in paddy fields after rice harvest. In the highlands, land-extensive traditional 'pioneer' shifting cultivation systems have now been replaced with intensive commercial production of cabbage and carrots, to the extent that they also show up in agricultural statistics. Even middle zone Karen living near the boundary with the upper zone have begun cultivating these crops in some areas. While some feel this has helped decrease the total area of land use and provide an option for farmers to stop producing opium, intensive use of agricultural chemicals, sprinkler irrigation and cultivation of steep slopes has brought a new generation of concern to downstream environmentalists. Despite these concerns, there are still very few systematic studies of the economics, agronomic sustainability or environmental impact of these systems.

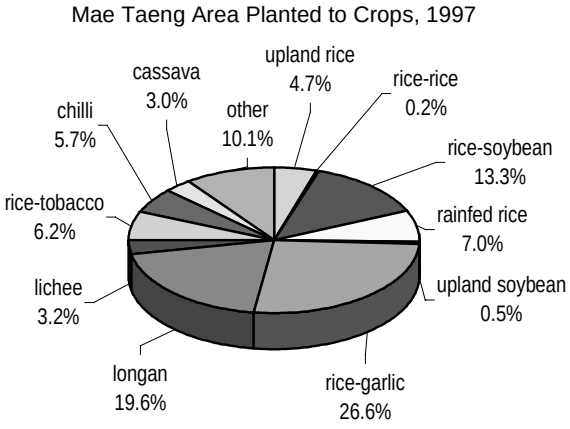
Figure 8: Mae Taeng Area Planted Crops, 1990 and 1997

One set of agricultural activities in the highlands that is not clearly captured by the agricultural statistics involves production of a fairly wide range of vegetables and crops that have been introduced under the Sam Mun Highland Development Project (SMHDP), where the field site was part of. In this area, some crops, such as barley, ginger and taro, are produced and marketed directly through private sector channels outside the project, while a range of other vegetables and flowers where produced and marketed with the assistance of the project and its extension system. Unlike other areas, some interesting land-use studies have already been conducted in portions of this area by researchers from the CMU, including some watershed work. Systematic socio-economic studies, however, are more recent and still in progress.

In terms of ***perennial horticulture***, expansion of fruit tree production beyond traditional home gardens is a quite recent direction for agriculture here, and was introduced primarily in association with various development projects. Most plantings that do exist, especially in the middle and upper zones, are still quite young, with only some plantings in now just beginning to produce commercial quantities of fruit. Even there, however, quality and marketing issues regarding these products have yet to be addressed fully, and there is not yet sufficient production to register in regional agricultural statistics.

Livestock production, particularly cattle raising, is another potentially fertile area of research. Its patterns are very complex and difficult to study, however, especially since undocumented imports from





crop	1990 area (ha)	1990 Yield (kg/ha)	1997 area (ha)	1997 Yield (kg/ha)
rice - rainy season	4,328.8	3,906	3,979.7	3,750
rice - dry season	34.4	3,963	16.3	3,906
upland rice	na	na	350.1	2,063
soybean - rainy season	26.1	1,063	36.8	1,688
soybean - dry season	2,077.1	1,244	994.4	1,588
garlic	661.8	16,244	1,981.9	13,324
onion	2.7	15,513	-	-
potato	49.9	na	75.4	18,438
cabbage	37.4	na	38.4	25,344
longan	736.8	706	1,465.3	99
lichee, litchy	216.2	1,538	236.0	106
tobacco	-	-	461.3	22,250
chili	-	-	421.8	18,695
casava	-	-	223.4	18,750
mungbean	-	-	128.0	1,375
ginger	-	-	111.2	28,125
sweet corn	-	-	74.2	12,922
maize	-	-	61.4	2,250
other	-	-	262.1	-

Source: Agricultural Extension Department.

Myanmar have begun to shift activities in many areas in the northern provinces adjacent to the border, so called 'fattening' operations for animals after their long trip before they are quietly slipped into commercial markets in north Thailand.

Regarding ***forest and other types of natural vegetation***, many villagers rely on wildlands for a wide range of products to meet subsistence needs, and there is some commercial trade, at least in a few major products. There is so little systematic study, however that little can yet be generalized from a more analytical point of view. Community forestry issues are now beginning to receive some attention by academics and NGOs and other small and large scale national and international projects.

One of the most recent additions to activities in some of the highland development projects has involved introduction of basic elements of ***community watershed networks and mosaic agroforestry*** system. Building on previous pilot projects in the area, many villages now have three-dimensional models of the terrain in their area, and they support them negotiate with the Royal Forest Department and other government authorities in developing mutually-agreeable local land use plans.

Overall, ***conflict*** among communities and between communities and government agencies has increased dramatically. Farmers from lowland and middle zones have begun to compete for upland soybean production sites along their boundary. Forestry authorities are applying pressure to reduce the total area of land used for forest fallow agriculture. Environmentalists are increasingly vocal about perceived negative downstream effects of middle and upper zone agriculture. And, villagers are trying to make a living. Various government agencies and NGOs have now begun trying to address these issues through projects that include promotion of various types of agroforestry systems and other improvements, some are being adopted at various locations in North Thailand, but very few have been subject to systematic evaluation of their environmental effects or financial and economic profitability. In the following figures the cropping calendar for the two major crops (paddy rice, upland rice) and pumpkin is used as an example for the growth of vegetables.

Figure 9: Crop calendar for Paddy Rice

Tasks	Task done	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
slash and burn	O												
seedbed preparation	X												
seedling taking care(age 60 days)	X												
land preparation	X												
transplanting (1-3 days)	X												
planting(1-3 days)	X												
1st fertilizing(after planted ~1 week)	X												
1st irrigation	X												
2nd irrigation	X												
Harvesting	X												
threshing (5-7 days)	X												
handling(2-3 days)	X												
Others													

X = yes O = no

Source: Ekasingh B., et al. (1999)

Figure 10: Crop calendar for Upland Rice

Tasks	Task done	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sep	Oct.	Nov.	Dec.
slash and burn	X												
Cleaning after slash&burn	X												
fence making	X												
Making cottage	X												
Planting/sowing	X												
1st weeding	X												
2nd weeding	X												
Harvesting	X												
Threshing (5-7 days)	X												
Handling(2-3 days)	X												
Others													

X = yes

O = no

Source: Ekasingh B., et al. (1999)

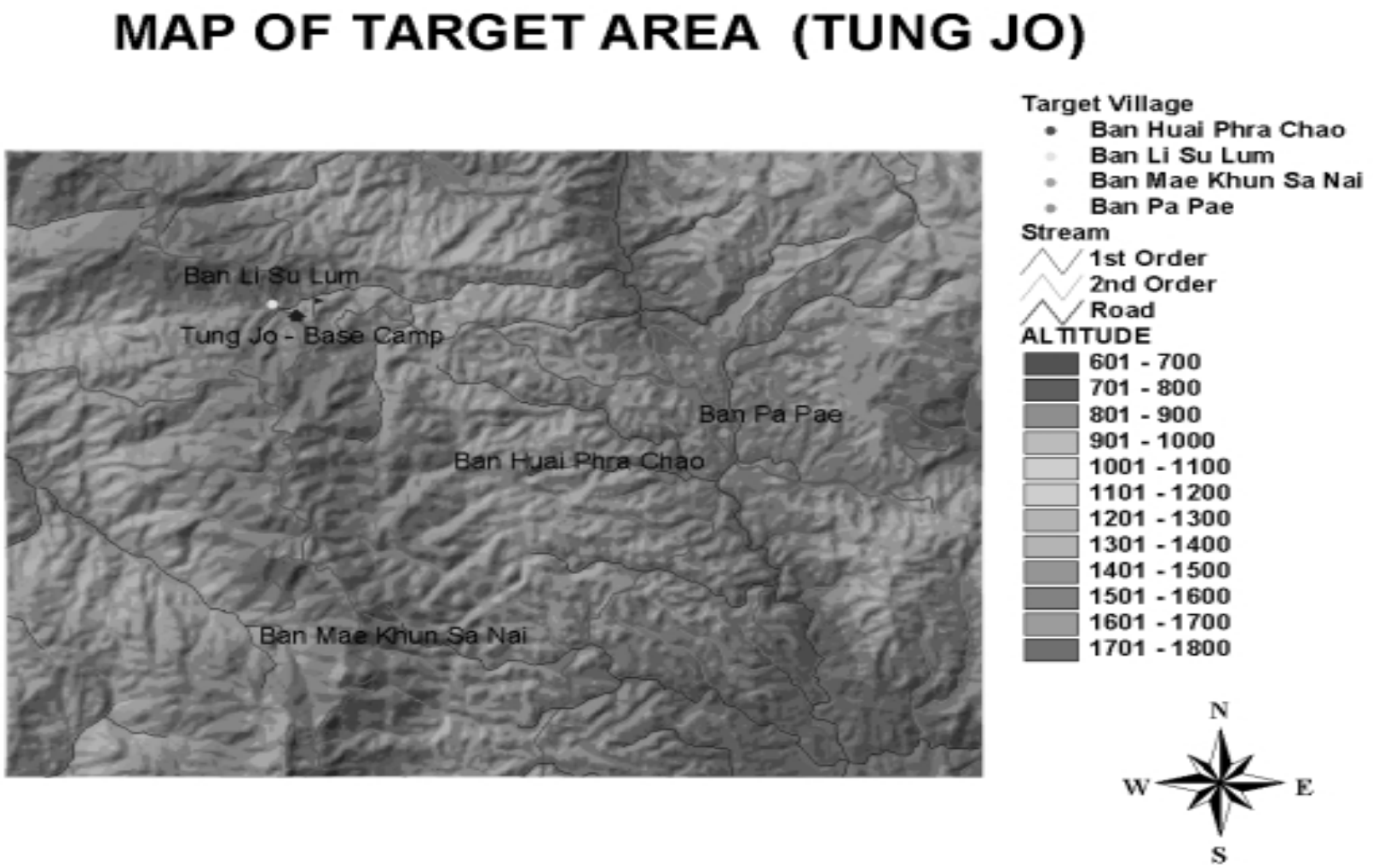
The crop calendars differ as pumpkin is planted and harvested twice/year and with higher inputs. Paddy rice is grown in the low valleys, close to rivers and small streams or where irrigation is possible, sometimes two crops/year. In purely rain fed systems maize and/or soy beans will be the second crop. Where irrigation is possible vegetables will be grown i.e. chili, onions, carrots, cabbage, ginger, garlic, green pepper, pumpkins, lettuce. On the steeper slopes and especially on newly slashed and burned land, upland rice will be cultivated during rainy season.

In comparing the above graphs it becomes obvious how different the labour requirement is between these three crops. Sometimes the villagers have to rely on outside labour for planting, weeding and harvesting on their own fields, but they will also be hired by other villages in times were there is not enough work for villagers who have to rely on supplementary income because of a lack of suitable land for cultivation.

In addition to crop cultivation and live stock i.e. cattle, pigs, poultry and fish are among the major sources of protein and can be found in most villages. Most of the ethnic minority groups are also well known for some kind of handy craft, i.e. weaving fabrics, tools, wooden instruments, etc. and form another source of additional income.

3.1.4 Field site

Figure 11:Target rea



Source: ICRAF, Chiang Mai

The 4 target villages (*Table 2*) for the field exercise are close to the Watershed Management Unit No. 1, Tung Jo. From 1987 until 1994 these villages were part of the Sam Mun Highland Development Project (SM-HDP), a joint co-operation between the Royal Forest Department and the United Nation Drug Control Program (UNDCP).

Table 2: The overview of 4 target villages.

Village	Ban Huai Phra Chao	Ban Khun Sa Nai	Ban Lum	Ban Pa Pae
Ethnic group	Karen	Hmong	Lisu	Local Thai
Religion	Buddhism	Christians	"Animist"	Buddhism
Households	42	93	46	181
Population	205	383	278	773
Average size of Farms (ha)	2.08	3.20	4.16	na
Land Tenure Security	No land title	No land title	No land title	RBT 5 Nor Sor 3
Main Farming Activities	Paddy rice, upland rice, maize Miang (fermented tea), vegetables	Vegetables (cabbage, paddy rice, maize, soybean), and fruit trees	Paddy rice, upland rice, maize, cabbage, fruit trees and cattle.	Paddy rice, Miang, and fruit trees
Altitude (m)	900	1,200	1,100	700
Cultivated Land (ha)	100	320	180	na
Forest of watershed includes:	Hill evergreen pine forest	Hill evergreen, deciduous, and pine forest	Hill evergreen pine forest	Mix deciduous, and hill evergreen forest

Source: Tung Jo Training Centre (Chaleo Kanchan) and Tan-Kim-Yong, U., et al. (1994)

One of the main goals of the project was the eradication of opium production, which was a major source of income for some of the ethnic minorities in the area. Most of the area is steep mountains, a main source of water supply for the urban areas in the Thailand. The project achieved an overall reduction of opium growing by 90 % by crop replacement with agricultural crops i.e. fruit trees, vegetables, maize, barley, potatoes and supported the development of rice paddy. Other activities included the improvement of public health conditions, education, general economic situation, facilitating the granting of Thai citizenship and I. D. cards, and to raise ecological awareness to protect the forest and watersheds.

The four target villages are inhabited by Karen (Ban Huai Phra Chao), Hmong (Ban Khun Sa Nai) Lisu (Ban Lum) and Local Thai (Ban Pa Pae). Main farming activities are listed in the table above. The cultivation of Miang (fermented tea) forms a major source of income for Ban Huai Phra Chao and B. Pa Pae. The trees (*Camelia sinensis*) are planted in the forest and the leaves are steamed in a bamboo or wooden container (Figure 12) after harvested. The leaves are left to ferment and sold bundled in packs. Traditionally the best quality will be chewed as a stimulant similar to Kat (C*atha edulis*) in some African countries. Leaves of lesser quality will be used for iced tea. The Miang tree only thrives in a forest environment and can not be planted as a mono crop. Therefore its cultivation is a means to preserve the forests surrounding the villages and helps to protect the environment by applying a true agroforestry practice.

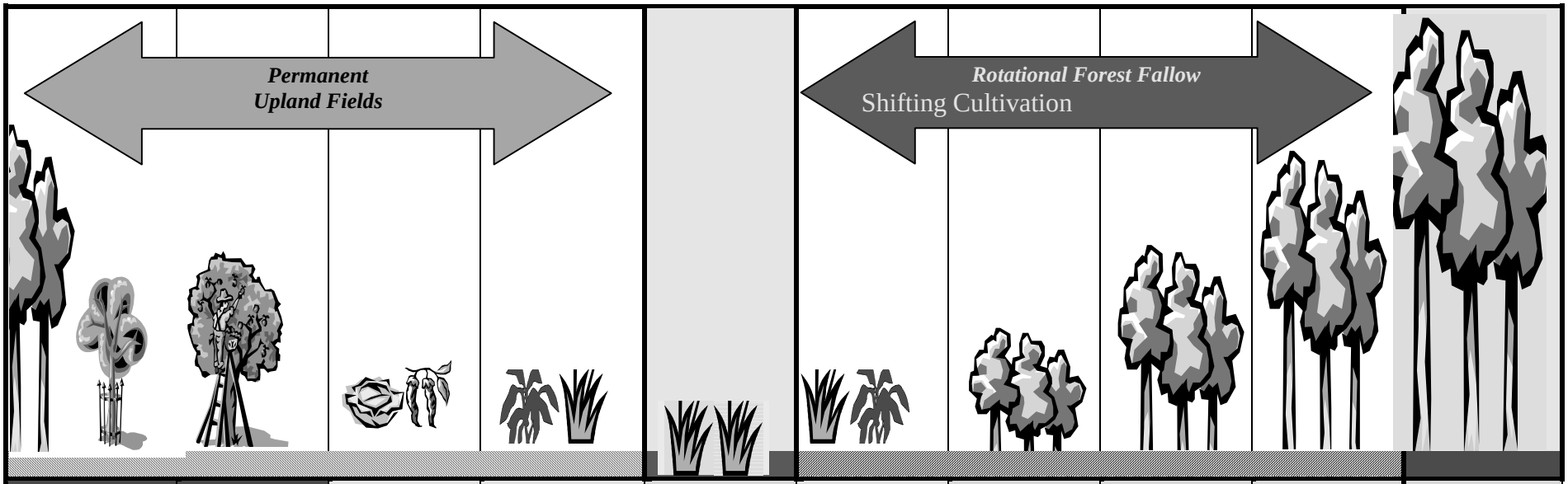
Figure 12: Traditional earth stove and container for steaming the tea leaves

Source: ICRAF, Chiang Mai

3.1.5 Major Farm Activities

In the figure below an overview is given on different farm activities and farming systems representative for upland farming in Thailand. The data is compiled from an area with similar farming systems as in Mae Taeng. It becomes obvious that even main activities as the cultivation of paddy rice can be observed in all villages, the rotation practice and the fallow period differs. This can also be said for agroforestry systems and horticulture.

Figure 13: Farming systems in selected villages in northern Thailand



LOC	Complex AGRO-FOREST	Tree HORTI-CULTURE	Annual HORTI-	Upland FIELD CROPS	Flooded PADDY	Upland ANNUAL	1-2 Year NATURAL	3-5 Year FOREST	6+ Year FOREST	Permanent NATURAL
M.Yot			*(some cabbage)*		Rice	**Rice + mixed**	Yes	Yes	Yes	Yes
M.Suk			???	???	**Rice**	**Rice + mixed**	Yes	Yes		Yes
(WS)			???	*Rice, Maize, Soybean*	**Rice**	**Rice + mixed**	Yes	Yes		Yes
M.Aep			*Cabbage*	???	**Rice**	**Rice + mixed**	Yes	*???*		[Mae Tho Park]
W.Chan		*(some fruit)*	**Various**	Rice	**Rice**	*Rice* (+ mixed?)	*Some*	Yes	Some	Yes
M.Pan				**Rice – soybeans**	**Rice** (-soybeans)	*Rice* (+ mixed?)	*Some*	*???*		Inth. Park
M.Raek				**Rice-soybeans**	**Rice** (-soybeans)	*Rice* (+ mixed?)	*Some*	*???*		Inth. Park
M.Lu				**Rice-soybeans**	**Rice** (-soybeans)	**Rice + mixed**	*Some*	*???*		Inth. Park
Outside locations	Miang tea	Fruit	***Various?***	???	???	???	*???*	*???*	*???*	Yes

Source: ICRAF, Chiang Mai (David Thomas)

3.1.6 Soils

The altitude range for upland cultivation is between 400 and 2500 m in northern Thailand, with slopes between 15 and 60 %. Soil organic matter varies between 2.0 and 7.2 % and correlates with the altitudes. Soil texture varies from loam to clay. pH is between 4 and 7. The available phosphor is lower than 7mg/kg and can therefore considered to be in the low range. Exchangeable potassium and calcium is usually in the medium range. Most of the soils can be classified as ultisols. Limiting nutrients for plant growth are nitrogen and phosphorous (Somchai Onprasert and Francis Turkelboom, 1996) Generally speaking the highland soils have favorable morpho-physical properties and poor to medium chemical properties

They show to be extremely variable (see Table 3). This variability is mainly determined by geology and landscape position (Mae Jo University).

Table 3: Overview of highland soil types (FAO classification) and soil characteristics

	Geological setting →			
Landscape position ↓	Granite-Gneiss	Shale-Phyllite-Schist	Sandstone-quarzite	Limestone-Marble
Crest	Acrisols	Acrisols	Leptosols	Leptosols
Slope	Acrisols Regosols Cambisols	Regosols Cambisols	Leptosols Regosols	Ferralsols?
Valley bottom	Regosols Gleysols			Ferralsols?
General characteristics	Deep-very deep SC-SCL-CL Good struct. Acid- m. acid Low-med. base Cont./sat.	Shall.–m. deep C-CL Good struct. Acid- m. acid Low-med. base Cont./sat.	Shall-m. deep and/or stony SL Weak struct.. Acid Low base cont./sat.	Deep C Vg struct. Neutral-sl. Basic High base Cont./sat.

Note: m=moderately; med=medium; Vg=very good; sl=slightly; Shall.=shallow; struct=structure; S=sand; L=loam; C=clay; cont.=content; sat=saturation

Source: Land Management Research for Highland Agriculture in Transition, Mae Jo University, 1996

3.1.7 Economy and Crops

In the following tables an overview is given to address the economic importance of various crops cultivated in the highlands. There input and labour requirements are listed and a comparison of the farm gate and social prices are given.

Table 4. Input-Output Table of Important Crops Grown by Karen Communities 1997

Input/output	Paddy rice	Upland rice	Pumpkin	Lettuce	Ginger	Taro	Green pepper	Gladiolus
Tradables								
Fertilizer (kg/rai)								
16-20-0	10.21	-	-	-	-	-	-	-
15-15-15	-	-	10.00	25.00	8.33	15.00	14.00	16.00
13-13-21	-	-	14.00	20.00	12.50		53.33	33.00
46-0-0	-	-	14.00	30.00	8.33	25.00	53.33	42.00
12-24-12	-	-	-	-	-	-	26.67	-
manure	31.25		95.63	129.75	85.71	60.00	280.00	75.00
Fungicide (cc/rai)								
Dithane	-	-	-	-	-	-	77.3	-
Manzate	-	-	-	-	-	-	-	3.0
Kumulus	-	-	400.0	-	-	-	-	200.0
Afugan	-	-	170.0	-	3.3	-	-	240.0
Insecticide (cc/rai)								
Ambush	-	-	-	640.0	-	-	1,120.0	0.0
Seed (unit/rai)	8.6	13.5	650.0	15.0	252.2	80.0	5,600.0	108.0
(seed unit)	kg	kg	no seedling	gram	kg	kg	no seedling	litre
Fuel (litres/rai)	7.2	-	4.4	-	-	-	-	-
Labor (mandays/rai)								
slash and burn	-	0.36	-	-	-	0.63	-	-
seedbed/seedling preparation	0.84	-	1.88	4.60	-	-	-	-
tillage	0.28	-	0.21	-	-	-	-	-
1st land preparation	1.62	1.86	7.16	8.00	10.56	28.03	8.00	8.00
2nd land preparation	1.79	0.26	-	-	2.52	-	-	-
planting	2.97	1.86	3.16	8.00	6.22	3.16	8.00	11.60
1st weeding	1.17	2.11	1.16	3.00	3.78	3.02	1.60	12.00
2nd weeding	0.52	2.31	0.21	0.80	3.93	1.79	1.60	12.00
3rd weeding	-	0.43	-	-	1.11	-	-	4.66
1st fertilizing	0.20	0.00	1.63	3.20	0.15	0.62	6.40	7.77
2nd fertilizing	-	0.00	1.11	1.60	-	-	6.40	7.77
chemical spray	-	0.00	1.09	0.07	-	-	0.91	0.66
irrigation	0.15	0.00	0.96	1.80	-	-	2.06	-
harvesting	4.69	2.49	3.26	3.83	4.44	2.95	8.00	18.88
threshing	2.62	1.20	-	-	-	-	-	-
handling	0.05	0.03	0.84	0.14	0.04	0.06	1.14	
others	-	0.43	0.11	-	-	1.26	-	24.11
Total labor use/rai	16.90	13.33	22.77	35.04	32.75	41.52	44.11	107.45
Capital								
Working capital	583.83	89.75	1,623.88	1,277.25	5,172.94	611.50	7,387.11	3,983.00
Tractor services (days/rai)	1.00	-	-	-	-	1.00	-	-
Transportation (trip)	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Land (rai)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-
Output per rai	400.1	202.5	966.4	998.3	341.7	528.7	1,266.7	11,282.7
(Unit of output)	kg	kg	kg	kg	kg	kg	kg	no. (heads)
Coefficient of variation	0.33	0.36	0.39	0.83	1.07	1.14	0.51	0.46
Risk level	Low	Low	Low	Med	Med	Med	Low	Low

Source: Ekasingh B., et al. (1999)

Table 5. Prices of Inputs and Outputs of Important Crops Grown by Karen Communities 1997.

Input/Output		Paddy rice	Upland rice	Pumpkin	Lettuce	Ginger	Taro	Green pepper	Gladiolus
Tradables									
Fertilizer (baht/kg)									
	16-20-0	8.00	-	-	-	-	-	-	-
	15-15-15	-	-	7.00	8.00	8.00	7.50	6.00	6.00
	13-13-21	-	-	7.00	8.00	8.00	-	6.00	6.00
	46-0-0	-	-	6.50	6.00	8.00	7.00	6.33	6.00
	12-20-12	-	-	-	-	-	-	7.00	-
	manure	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Fungicide (baht/cc)									
	Dithane	-	-	-	-	-	-	2.00	-
	Manzate	-	-	-	-	-	-	-	2.00
	Kumulus	-	-	0.15	-	-	-	-	0.10
	Afugan	-	-	0.25	-	3.50	-	-	0.15
Insecticide (baht/cc)									
	Ambush	-	-	-	0.25	-	-	0.20	0.20
Seed (baht/unit)		4.00	3.84	1.00	3.00	19.00	3.30	1.00	30.00
(seed unit)		kg	kg	no.seedling	gram	kg	kg	no.seedling	litre
Fuel (baht/litres)		12.00	-	12.00	-	-	-	-	-
Labor (baht/manday)									
slash and burn		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
seedbed preparation		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
tillage		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
1st land preparation		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
2nd land preparation		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
planting		65.00	65.00	50.00	50.00	50.00	50.00	50.00	50.00
1st weeding		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
2nd weeding		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
3rd weeding		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
1st fertilizing		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
2nd fertilizing		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
chemical spray		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
irrigation		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
harvesting		65.00	65.00	50.00	50.00	50.00	50.00	50.00	50.00
threshing		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
handling		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
others		50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Capital (baht)									
Working capital		0.15	0.15	0.09	0.09	0.15	0.15	0.09	0.09
Tractor services		350.00	-	-	-	-	168.00	-	-
Transportation		-	37.78	463.75	402.50	50.00	-	200.00	60.00
Land (baht/rai)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Output Prices (baht/unit)		3.76	3.76	8.00	8.00	2.50	3.33	15.00	1.24
(unit of output)		kg	kg	kg	kg	kg	kg	kg	no. (heads)
Coefficient of variation		0.00	0.00	0.00	1.18	2.51	1.09	0.42	0.23
Risk level		Low	Low	Low	Med	High	Med	Low	Low

Source: Ekasingh B., et al. (1999)

Figure 14: Output price comparison for different crops

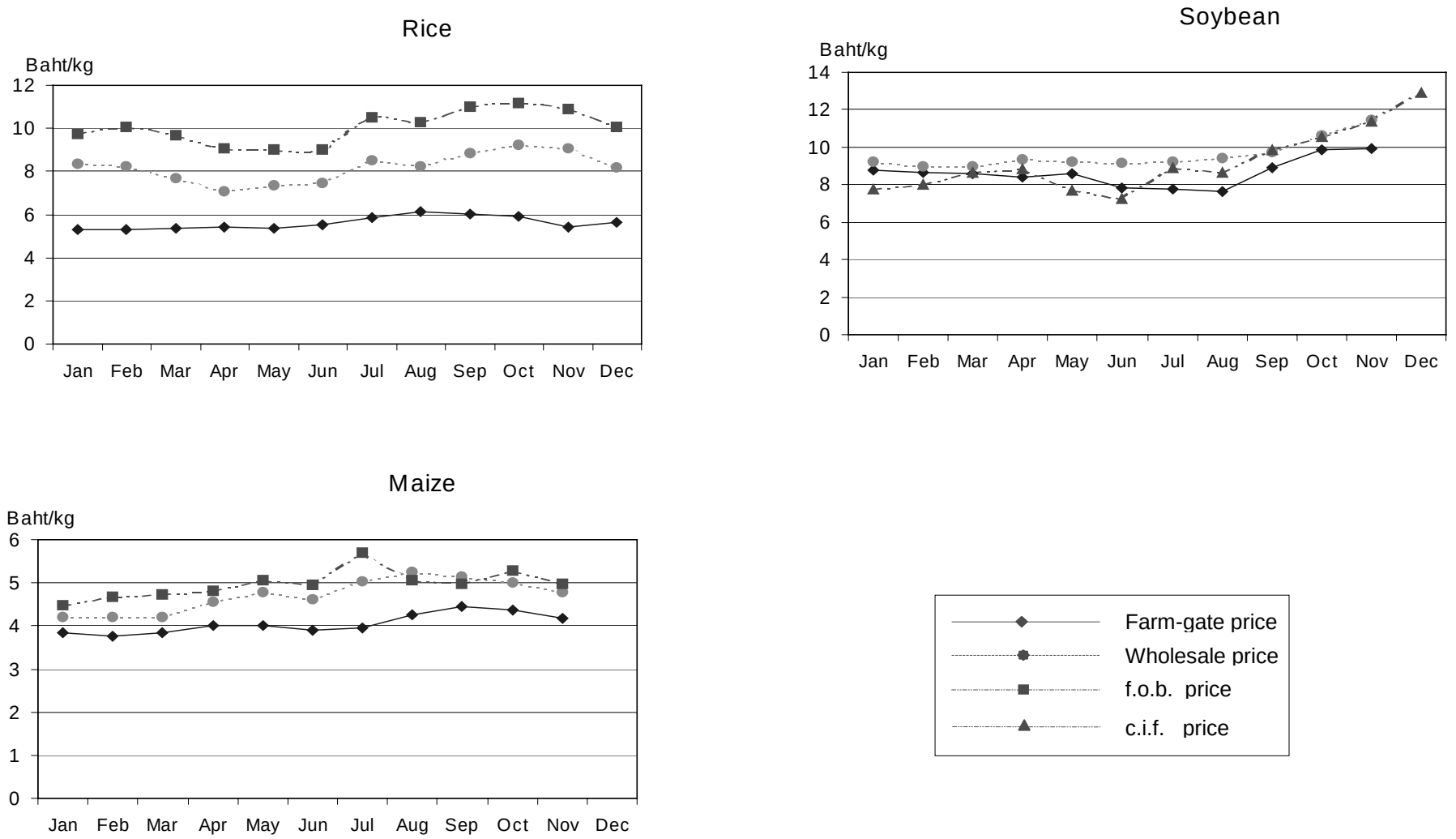
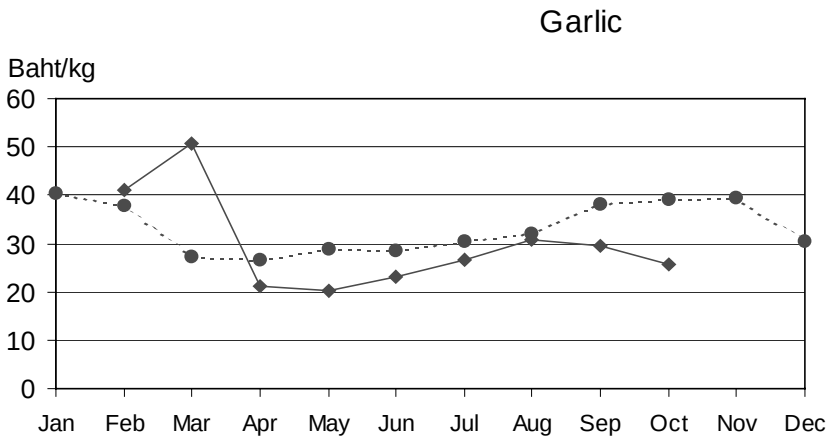
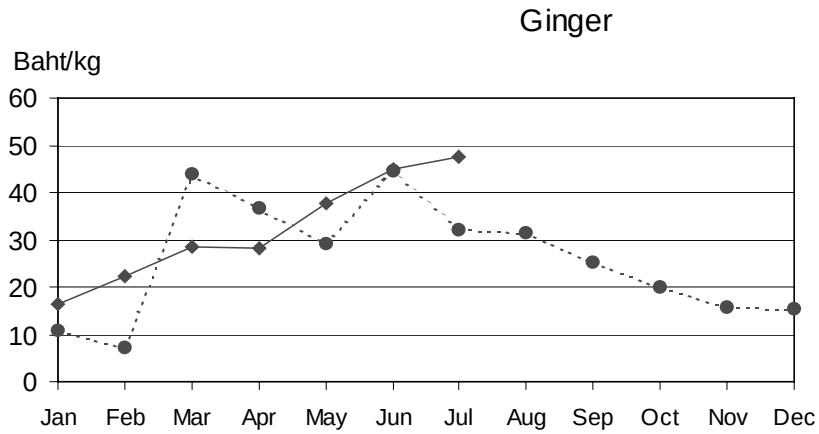
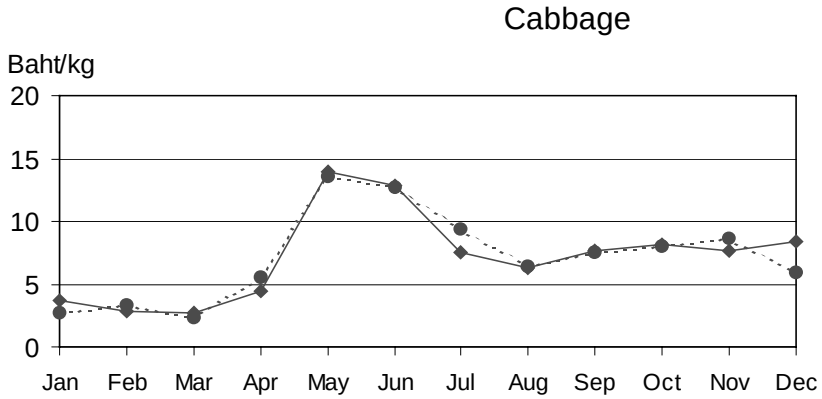
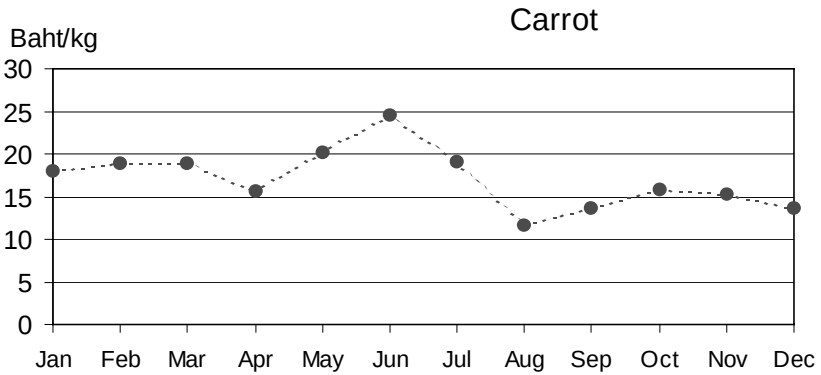


Figure 15: Output price comparison for different crops









3.2. Forest types of northern Thailand

The above described farming systems are part of an ecosystem where forests are an integral part of. They can not be seen as a stand alone system, the surrounding forests are as important to the farming communities as their cultivated land. These forests are another source of food with non timber forest products i.e. mushrooms, wildlife, herbs and medicine plants and also a source for timber for construction, grass for thatched roofs, bamboo, etc.

In the past up to 70 % of the land area of Thailand was covered by forests (Credner, 1937). According to the Royal Forest Department the remaining forest area is 27 % (RFD, 1997). Other sources state the percentage of forest cover to be as low as 15 % (FAO, 1997). It is not only the figures who do not match but also the definition of "Forest" somewhat differs between agencies and depending on the source of information utilized for the assessment (WEYERHAEUSER, 1998). If for example only satellite data is used without or insufficient ground truthing, areas of degraded forests and even areas completely covered by Imperata cylindrica will be assigned to forest. The highest impact in forest destruction was often blamed on the hill tribe communities due to their shifting cultivation practices. The rate of destruction in the north was definitely high in some areas in the late 60's and up to the end of the 80's. During this period the forest cover was cleared to grow the opium poppy (*Papaver somniferum*) and for cash crop promotion (UNITED NATIONS, 1991). In the past the ethnic minorities usually cleared only small plots for their fields, planted their crops for one ore two years and moved on to another plot, leaving the land to recover. As recent studies show (SCHMIDT-VOGT, 1997) the impact depends on the origin of the minorities and the cash crop they are planting: it is impossible to draw the general conclusion that shifting cultivation itself is the main cause of the forest destruction.

Throughout the history of human settlement in Thailand fire has had an impact on the forests. Fire has been used for land clearing, hunting, to burn dry grass to allow new growth for browsing of cattle, to allow better gathering of non wood forest products such as edible wild plants, mushrooms, small animals and also as a treatment to improve soil fertility after clearing forest land for shifting cultivation. The latter occurred close to the settlements and therefore was well controlled, whereas the other incidents, especially when land is illegally cleared for commercial purpose, often happen without any care and control. They are mostly responsible for the loss of large tracks of forests in Southeast Asia.

A overview of the forests prevailing in the north is given in the following chapters.

3.2.1 Deciduous Forests

In areas with medium to low annual rainfall levels, pronounced dry seasons and sandy, gravely-loamy or lateritic soils, the forests become partly or wholly deciduous, with trees shedding their leaves during the dry season. Deciduous forests might extend into areas where rainfall levels are higher but with the dry seasons extremely prolonged.

Primarily based on the availability of precipitation, SMITINAND (1992) has sub-grouped deciduous forests in Thailand into

- **M**ixed **D**eciduous **F**orest,
- **D**ry **D**eciduous **D**ipterocarp **F**orest
- **S**avannah **F**orests.

In other classifications these forests are grouped under the heading of Tropical Semi-Evergreen Forests (FAO, 1981).

3.2.2.1 Mixed Deciduous Forests

With regard to Thailand, Mixed Deciduous Forests can be sub-divided into:

- Moist Upper Mixed Deciduous Forest
- Dry Upper Mixed Deciduous Forest
- Lower Mixed Deciduous Forest

While the first two types contain teak, the third does not. Other authors refer to these forests as Tropical Moist Deciduous Forest (TROUP, 1921) or Seasonal Forest (SUKWONG, 1974). The two drier types of this group are also called Tropical Dry Deciduous Forests (FAO, 1981).

Generally, a large number of deciduous species occur, without any clear dominance which makes it difficult to present a composition-based description. Exceptions are areas where *Tectona grandis* can exhibit it gregarious tendencies and dominates. Such stands might conveniently be called teak forests.

a. Moist Upper Mixed Deciduous Forest

This forest type is also referred to as Tropical Moist Deciduous Forest (FAO, 1981). In Thailand, it occurs between 300 to 600 m.a.s.l., usually on loamy, deep soils, both of limestone and granite origin. The structure is three-storied:

- The upper layer consisting of *Tectona grandis, Lagerstroemia tomentosa, L. calyculata, Terminalia alata, T. calamansanai, T. bellerica, Afzelia xylocarpa, Xylia kerrii, Bombax insigne, Pterocarpus macrocarpus, Dalbergia cultrata, D. oliveri, Haldina cordifolia, Gmelia arborea, Anogeissus acuminata, Millettia leucantha, Albizia lebbeck, A. procera, A. lebbekiodes, A. chinensis, Acacia leucophloea, Adenanthera pavonina* and *Dillenia pentagyna.*
- The second storey typically contains *Combretum quadrangulare, Careya arborea, Barringtonia racemosa, Millettia brandisiana, Albizia ludica, Dalbergia ovata, D. nigrescens, Peltophorum dasyrachis, Lagerstroemia floribunda, L. speciosa, L. macrocarpa, L. villosa, L. undulata, Diospyros mollis, D. montana, Eugenia cumini, E. leptanthum, Vitex penduncularis, V. canescens, V. pinnata,* and *Dillenia aurea*
- The lowest storey is composed of *Cratoxylon formosum, Mallotus philippinensis, Gardenia coronaria, G. obtusifolia, Casearia grewiaefolia, Bauhinia racemosa, B. malabarica, Croton oblongifolius* and *C. hutchinsonianum.*
- Small number of palms, such as *Phoenix humilis* and some species of *Calamus* occur frequently.
- Shrubs are represented by species of *Croton spp., Malotus spp., Premna spp.,* and *Randia spp., Harrisonia perforata, Bauhinia acuminata.*
- Lianas include *Hymenopyramis brachiata, Congea tomentosa, Artabotrys siamensis, Desmos spp., Bauhinia bracteata, B. scandens, Butea superba, Spatholobus parviflorus* and *Dalbergia rimosa.*

- The ground flora is composed of herbaceous species such as grasses of the genera *Capillipedium, Sporobolus, Themeda, Thysanolaena, Andropogon, Bothriochloa, Saccharum, Orzya, Eragrostis,* and *Hyparrhenia.* Others are *Kaempferia, Curcuma, Boesenbergia, Fimbristylis, Carex, Cyperus, Ceropegia, Aristolochia, Habenaria, Peristylis, Pecteilis* and *Brachycorythis.*

b. Dry Upper Mixed Deciduous Forest

Due to exposure, high evaporation, surface erosion and the leaching of organic components from the soil, the vegetation along ridges becomes more open. Though the forests are still three-layered and most of the species of the Moist Upper Deciduous forest are present, they exhibit stunted and crooked forms. More deciduous species like *Shorea obtusa, S. siamensis, Dipterocarpus tuberculatus, D. obtusifolius* and *D. intricatus* begin to appear.

Figure 16: Mixed Deciduous Forests, picture taken during a helicopter flight in May 1997

The ground flora is frequently destroyed by dry season fires. If fire frequency is high, the forest may degrade into a bamboo sward, dominated by species like *Bambusa arundinacea* and *Thyrsostachys siamensis.*

c. Lower Mixed Deciduous Forest

Lower Mixed Deciduous Forest occurs in dry areas, usually between 50 to 300 m.a.s.l., with reasonably deep sandy or lateritic soils. In structure it is similar to Upper Mixed Deciduous Forest, but *Tectona grandis* is suspiciously absent from the canopy layer. In some situations *Hopea odorata, H. ferrea* and *Shorea roxburghii* occur. Along rivers a "gallery forest" version can be found, containing semi-evergreen species like *Eugenia cumini, Sapium insigne, Afzelia xylocarpa* and *Dipterocarpus alatus.*

3.2.2.2 Dry Deciduous Dipterocarp Forests

Undulating plains and ridges, low levels of rainfall, porous, heavily eroded and leached sandy or lateritic soils of both granitic and sandstone origin and frequent fires are characteristic for the areas in which Dry Deciduous Dipterocarp Forests occur. Structurally, the forest is open and two-storied:

Figure 17: Cycus siamensis in a fire affected DDF stand

The canopy-layer is predominantly composed of xerophytic species of the *DIPTEROCARPACEAE* family, hence the name. Common species include *Dipterocarpus obtusifolius, D. tuberculatus, Shorea obtusa* and *S. siamensis*. Sometimes *Quercus kerrii, D. intricatus, Pterocarpus macrocarpus* and *Xylia xylocarpa* are interspersed.
The lower storey is composed of shrubs like *Strychnos nux-vomica, S. nux-blanda, Dalbergia kerrii, Symplocos cochinchinensis, Diospyros ehretioides, Aporusa villosa, Phyllanthus emblica* and *Canarium subulatum.*
The ground flora consists of species that have distinct fire adaptation mechanism, including under-ground tubers and the ability to re-sprout from rootstock.
Small bamboo species commonly found include *Arundinaria pusilla, A. ciliata, Linostoma persimilis, Enkleia malaccensis, Phoenix acaulis* and *Pygmaeopremna herbacea*. Other ground flora genera include *Habenaria, Pecteilis, Hibiscus, Decaschistia, Kaempferia* and *Curcuma. Dillenia hookeri* is common, forming clumps of low bushes.
In areas of laterite soils and often frequented by fire, *Cycas siamensis* (Figure 17) occurs.
Epiphytes are common and mostly consist of ferns belonging to the genera *Platycerium* and *Pyrrosia* and orchids of the genera *Aerides, Eria, Dendrobium, Bulbophyllum, Cleisostoma* and *Ascocentrum.*
Dischidia rafflesiana, D. minor, Hoya pachyclada and *H. kerrii* are also common.

Figure 18: Previously logged and fire affected DDF stand

Based on the floristic composition, BUNYAVECHEWIN (1985) has suggested a three-class sub-division of the Dry Deciduous Dipterocarp Forests.

Class 1

- Figure 18) represents stands consisting mainly of *Shorea siamensis, S. siamensis var. tomentosa* and *S. obtusa*.
- Class 2 is dominated by *Dipterocarpus tuberculatus* and *D. obtusifolius* with a sub-type that also contains upper-storey bamboo.

  The author points out that class 2 community-type changes when moving from the West to the East of Thailand. In the West *D. tuberculatus* dominates (called "Kanyin“ in Manipur in India and "Indain“ in Myanmar), in the East *D. obtusifolius* ("Forêt Claire“ in French-speaking Indochina). A similar sub-division of Dry Dipterocarp Forests has been suggested by KUTINTARA (1975).
- Class 3 is identical with the Pine-Dipterocarp association as suggested by SMITINAND (see below). The actual species were not specified.

KUTINTARA and BHUMPAKKAPUN (1989) note a dwarf-variety of Dry Deciduous Dipterocarp Forest. The validity and purpose of such sub-classification remains doubtful since the site investigated lies on a ridge, over granite intrusions, on a shallow, crumbly, quartz-rich soil of low water-holding potential. More likely it is Dry Deciduous Dipterocarp Forest as described by SMITINAND (1992), occurring on a very marginal site.

3.2.2.3 Savannah Forests

By definition, savannah forests are characterised by grasslands where medium-height trees occur scattered, leaving an open structure. Soils are similar to those found in Dry Dipterocarp Forests but precipitation is often as low as 500 mm per annum. Forest fires are frequent.

Besides xerophytic tree species such as *Careya arborea, Mitragyna parvifolia, Acacia siamensis, A. catechu* and *Pterocarpus macrocarpus,* thorny shrubs such as *Feroniella lucida* and *Carissa cochinchinensis* are interspersed with *Bambusa arundinacea*.

In upper elevations shrubs of the genera *Aporusa, Ochna* and *Glochidion* are frequent.

The grass layer is composed of *Imperata, Vetiveria, Eulalia, Panicum, Sporobolus, Themeda, Eriochloa* and *Sorghum.*

In higher parts of the Thung Yai Wildlife Sanctuary in western Thailand, savannah grasslands interspersed with *Cycas siamensis* can be found. NAKHASATIEN and STEWART-COX (1990) considered this an unique grassland formation rather than an extremely fire-degraded form of Dry Dipterocarp Forest.

Savannah forests have been discussed in length by STOTT (1990) and KANJANAVANIT (1992).

3.2.2 Evergreen Forests

On the basis of climatic factors, SMITINAND sub-divides evergreen forests into Tropical Rain Forests and Dry Evergreen Forests. ASHTON (1990) on the other hand, groups it under the name of Seasonal Lowland Evergreen Mixed Rain Forest.

Within this group several regional types are distinguished that partly coincide with the classification as applied by SMITINAND (1992) for the Thai forests.

ASHTON estimates that this forest type in the past covered 1,200,000 km^2 of tropical Asia. Based on TROUP (1921), CHAMPION (1936), SENGUPTA (1939) and CHAMPION et al., (1965, 1968), such evergreen forests were originally found along most of the west-facing lower mountain ranges in India and Mainland Southeast Asia, where the Southwest monsoon leads to heavy orographic rains. It includes the western peninsular India, the Darjeeling-Assam-Chittagong-Arakan range, the western part of the Central Cordillera between parts of Yunnan to northern peninsular Malaysia and areas reaching as far north as coastal Guanxi and Hainan.

The most common soils are yellow and red ultisols and oxisols. Evergreen forests usually receive annual rainfall of 1,500 to 6,000 mm, in exceptional circumstances exceeding 10,000 mm. Dry seasons are short. The months where evapo-transpiration exceeds precipitation are usually less than five.

In contrast to CHAMPION (1936), ASHTON (1990) delineates these forests against the mixed dipterocarp forests of the Sunda shelf, the Philippines and Southwest Sri Lanka on the basis of their distinct floristic composition, their species richness and their phenology and dynamics.

In terms of composition and structure, these forests are usually multi-layered with canopy tree heights exceeding 40 m. Species are very numerous and are chiefly or entirely evergreen; gregariousness is strikingly absent. The forests are rich in climbers, palms and woody and herbaceous epiphytes (TROUP, 1921).

3.2.3 Tropical Rain Forests

After SMITINAND, Tropical Rain Forests, also known as Moist Evergreen Forest (WHITMORE, 1984) and as Tropical Wet Evergreen Forests (CHAMPION et al., 1968), are usually confined to areas of rainfall above 2,500 mm per year and a dry season not exceeding three month. According to SMITINAND (1992), in Thailand two zones can be recognised, the Lower Tropical Rain Forest and the Upper Tropical Rain Forest.

3.2.3.1 Lower Tropical Rain Forest

Usually, Lower Tropical Rain Forest occurs in areas up to 600 m.a.s.l. According to SMITINAND, it is two-storied, but in other descriptions three-storey structures are mentioned (e.g. WHITMORE, 1984).

- The upper layer is composed predominantly of large-sized, *hygrophilous DIPTEROCARPACEAE* species of the genera *Dipterocarpus, Hopea, Shorea, Balanocarpus, Parashorea, Anisoptera* and other species such as *Dyera, Endospermum, Horsfieldia, Melanorrhoea, Palaquium, Planchonella, Mangifera, Swintonia, Ailanthus, Cedrela, Artocarpus, Bischofia, Sandoricum, Tetrameles, Pterocymbium, Scarphium, Sterculia, Intsia, Mesua, Pterospermum. Schima, Cinnamomum, Calophyllum, Litsea, Alstonia, Ficus, Adenanthera, Koompassia, Lagerstroemia, Neophelium, Manglietia* and *Podocarpus* (SMITINAND, 1992).
- The lower storey is composed of trees of medium height and diameter, including the genera *Vatica, Talauma, Baccaurea, Alchornica, Macaranga, Mallotus, Drypetes, Cleistanthus, Glochidion, Croton, Cleidion, Antidesma, Aporosa, Dichapetalum, Streblus, Eugenia, Phoebe, Alseodaphne, Aglaia, Garcinia, Memecylon, Polyalthia, Mitrephora, Goniothalamus, Pseuduvaria, Orophea, Gluta* and *Semecarpus*
- Palms, such as *Orania, Oncosperma, Calamus, Korthalsia, Daemonorops* and *Licuala* are abundant.
- Vines are common such as *Bauhinia, Dalbergia, Millettia, Tetrastigma, Willughbeia, Aganosma, Poikiolospermum, Trachyspermum, Epigynum, Derris* and *Entada*.
- Bamboo cover disturbed areas, belonging to the genera *Gigantochloa, Bambusa, Dinochloa, Schizostachys* and *Dendrocalamus* (SMITINAND, 1992).

3.2.3.2 Upper Tropical Rain Forest

In other classifications this forest-type is grouped under Tropical Montane and Hill Evergreen Forest (FAO, 1981). Upper Tropical Rain Forests are found on slopes between 600 to 1,000 m.a.s.l. and represent a transition between the Lower Tropical Rain Forest and the higher Hill Evergreen Forest (see below). In Thailand they are usually two-storied:

- The upper storey composed of species of the genera *Quercus, Lithocarpus* and *Castanopsis*, interspersed with members of the genera *Magnolia, Michelia, Eugenia, Pentacme, Dipterocarpus, Myristica, Canarium* and *Podocarpus*.
- The lower storey include *Antidesma, Aglaia, Baccaurea* and *Glochidion*. *Areca, Pinanga, Calamus* and *Daemonorops* palms are abundant.

- The undergrowth is usually dense and dominated by *MELASTOMATACEAE, ACANTHACEAE* and *ZINGIBERACEAE,* with a great number of terrestrial ferns and orchids.
- Climbers are few and scattered, but epiphytes are abundant.

Trees are usually heavily covered with mosses, ferns and orchids.

3.2.4 Dry Evergreen Forest

Other authors refer to this forest-type as Seasonal Evergreen Forest (NAKHASATIEN and STEWART-COX, 1990) and Tropical Semi-Evergreen Forest (WHITMORE, 1984). In areas receiving 1,000-2,000 mm rainfall per annum this was once a wide-spread forest formation that could be found all over the plains of Thailand, but particularly luxuriant in depressions, along the valleys of the lower hill ranges up to 500 m.a.s.l. (SMITINAND, 1977). NAKHASATIEN and STEWART-COX (1990) quote altitudes of 800 to 1,000 m.a.s.l. BUNYAVECHEWIN (1983) points out that it is difficult to define this forest by elevation since it is more associated to streams rather than a particular altitude zone. As such it might form gallery forest along streams and rivulets in areas that receive relatively little precipitation, which could be considered an edaphic formation.

In its structural complexity Dry Evergreen Forests can be similar to rain forest. However, due to the agricultural potential of the mostly deep and fertile soils and the highly valued timber of many species in this formation, in Thailand most of this forest has disappeared in recent decades.

The forests are usually three-storied:

- The upper storey consisting of the species *Anisoptera costata, Dipterocarpus alatus, D. turbinatus, Hopea odorata, H. ferrea, Shorea thorelii, Alstonia scholaris, Pterocymbium tinctorium, Tetrameles nudiflora, Afzelia xylocarpa, Ailanthus triphysa, Ulmus lanceifolius, Antiaris toxicaria, Lagerstroemia ovalifolia* and *Acrocarpus fraxinifolius.*
- The second storey is composed of *Cratoxylum maingayi, Chaetocarpus castanicarpus, Castanopsis nepheloides, Euphorbia longana, Lithocarpus harmandii, Spondia pinnata, Cinnamomum iners, Irvingia malayana, Vatica cinerea, Sapium insigne* and *Diospyros spp.*
- The lower storey is dominated by the genera *Memecyclon, Cleistanthus, Aporusa, Alchornea, Baccaurea, Macaranga, Mallotus, Knema, Melodorum, Mitrephora, Tarenna, Dillenia, Crateva* and *Maerua.*
- Palms of the genera *Calamus, Areca, Livistona* and *Corypha* can be found,
- Bamboo of the genera *Gigantochloa, Bambusa* and *Dendrocalamus*.
- Lianas area abundant, belonging to the genera *Bauhinia, Dalbergia, Derris, Entada, Strychnos, Securidaca, Toddalia, Acacia, Hymenopyramis, Congea, Sphenodesme, Uncaria, Ventilago, Tedrastigma, Artabotrys, Desmos, Uvaria* and *Pisonia.*
- Strangling figs are also frequent
- Epiphytes, mainly orchids and ferns, are sporadic.
- The undergrowth is dense and composed of members of the family *ZINGIBERACEAE* (*Curcuma, Boesenbergia, Alpinia, Catimbium, Cenolophon* and *Amomum*). Other genera are *Tacca, Strobilanthes, Micromelum, Clausena, Barleria, Desmodium, Moghania, Christia* and *Capparis* and ferns of the genera *Helminthostachys, Lygodium* and *Thelypteris*.

3.2.5 Hill Evergreen Forest

Also known as Temperate Evergreen Forest or Lower Montane Rain Forest (WHITMORE, 1984), this forest-type occurs discontinuously in areas above 1,000 m.a.s.l., particularly in the northern highlands of Thailand. Soils are either red-granitic, brown-black calcareous or yellow-brown sandy. Precipitation lies between 1,500 and 2,000 mm per annum, air humidity is high and temperatures are reduced compared to the lowlands.

The forest is mostly two-storied and dominated by the genera *Quercus, Castanopsis, Magnolia, Rhododendron*, laurels and teas. It is species-rich. Crown cover of the upper canopy trees and undergrowth are dense. On moist slopes and in valleys this forest can reach canopy heights similar to Dry Evergreen Forest, but on drier ridges it is open-structured with heights of 10 to 15 m only (NAKHASATIEN and STEWART-COX, 1990).

Sites investigated by SMITINAND (1992), in Thailand revealed following structure and composition:

- The upper storey is characterised by *Schima wallichii, Cinnamomum spp.., Fraxinus excelsa, Dacrydium elatum, Podocarpus imbricatus, Cephalotaxus griffithii, Betula alnoides, Umus lancifolia, Cedrela toona, Nyssa javanica, Quercus, Lithocarpus, Castanopsis* and *Calophyllum.*
- The second layer is composed of *Gordonia, Camellia, Pyrenaria, Acer, Careya, Carpinus, Tristania, Sladenia celastrifolia, Notophoebe, Alseodaphne, Lindera, Phoebe, Helicia, Macaranga, Mallotus, Rhododendron, Symplocos* and *Aquilaria.*
- Shrubs are also abundant, belonging to the genera *Daphne, Melastoma, Osbeckia, Embelia, Maesa, Rapanea, Rhamnus, Cornus* and *Osyris*.
- Palms are relatively few (*Pinanga, Phoenix, Cycas* and *Gnetum*).
- Herbaceous species form a rich ground flora and are represented by *Catimbium, Boesenbergia, Curcuma, Globba, Hedychium, Strobilanthes, Asystasia, Calanthe, Malaxis, Habenaria, Anoectochilus, Anthogonium, Pollia, Streptolirium* and *Ophiorrhiza. Bamboo* are *Teinostachys, Dinochloa, Gigantochloa* and *Schizostachys.* Ferns are richly presented, including species of Asplenium, *Leptochilus, Polypodium, Thelypteris, Nephrolepis, Blechnum, Cyathea* and *Osmunda*.
- *Sphagnum* are found in boggy areas of high altitude and sub-alpine vegetation-types in areas on summits and exposed ridges.

3.2.6 Particular Edaphic Forest Formations

3.2.6.1 Limestone Formations

In many parts of the country limestone ridges and cliffs can be found that contain a specific forest community. Though its floristic composition is partly reminiscent of Moist Upper Mixed Deciduous Forests (compare above), the community is strongly conditioned by the calcareous nature of the parent material. However, despite obvious particularities, the community-type has not been studied in detail.

3.2.7 Coniferous Forest

Coniferous forests represent only a small proportion of the region's forests. In Thailand they represent less than 2%. However, in comparison to other forest types they have received relatively considerable scientific attention. They are found in areas of 200 to 1,300 m.a.s.l.

Rainfall levels lie between 1,000 and 1,500 mm per annum. Soils are usually poor and acid, greyish-sandy, brownish-gravely or lateritic.

Structurally, they are two to three-storied and rather open. In areas where fires are frequent, the forest can take a savannah-like structure.

- The upper storey is composed of *Pinus kesiya* and *P. merkusii*. In areas where lateritic soils occur this might also include *Dipterocarpus obtusifolius* and *D. tuberculatus*, forming a *Pinus-Dipterocarpus* association.
- The second storey is composed of the regeneration of the canopy trees, combined with *Anneslea fragrans, Quercus, Lithocarpus, Castanopsis, Styrax aprica, Myrica* and *Tristania rufescens.*
- The lower storey is composed of small trees and tall shrubs such as *Adinandra, Embelia, Maesa, Phoenix humilis, Cycas pectinata, Vaccinum sprengelii, V. bracteatum, Rhododendron moulmeinense, R. lyi, Baeckia frutescens* and *Styrax rugosus* (SMITINAND, 1992; WERNER, 1993)

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4. EXERCISE GUIDELINES

4. EXERCISE GUIDELINES

4.1. EXERCISE COORDINATORS

Preparing a C&D exercise starts at least a few weeks before the beginning of the training course and the exercise and may take up quite some time if it is to be done correctly. A badly prepared exercise will not only waste time for all involved but will also have little or no training value whatsoever. Observe the following steps when preparing, coordinating and implementing a C&D exercise:

1. **SELECT A TARGET LAND USE SYSTEM**
2. **INFORM LOCAL AUTHORITIES**
3. **SELECT FIELD AGENTS/INTERPRETERS**
4. **SELECT FARMS**
5. **DEVELOP A PROGRAMME**
6. **ARRANGE LOGISTICS**
7. **COMPOSE MULTI-DISCIPLINARY TEAMS**
8. **SELECT TEAM LEADERS**
9. **IMPLEMENT/COORDINATE THE EXERCISE**
10. **REVIEW AND EVALUATE EXERCISE**

4.1.1. SELECT TARGET LUS

If you have a choice in selecting a target land use system for a C&V training exercise, you may want to consider the following criteria.

- **Characterization**
- **Accessibility**
- **Visits**

Select a land use system in an area that has been **sufficiently characterized** and for which **extension recommendations** are available (see "Characterization information" in this exercise book).

The implementation of a good C&D exercise depends heavily on the availability of reliable information and a good characterization of the land use system at the community level. If such information is sparse or not available at all, exercise participants may spend most of their time trying to obtain it during the exercise and will have no real framework for comparison or verification allowing diagnosis at the household level.

If the information is not available at the community level, check at a higher level (region, nation) for relevant characterization or conduct a macro C&D as to obtain a minimum of data and information from secondary sources and key informants (Ministry representatives, extension services, NGOs, parastatals, projects).

Select a land use system that is **easily accessible**, especially when adverse weather conditions can be expected, and where distances between a central point (accommodation, training course venue) and farms to be visited are within reason.

Time is very precious during a short C&D training exercise and must be used for interaction with farmers and amongst participants, not to cover lengthy distances or get bogged down in sand or mud.

Ideally, select a land use systems where the group can **make a visit to a relevant research or development activity** in agriculture, forestry, livestock or agroforestry.

Such a visit organized either at the beginning or towards the end of the exercise, will allow exercise participants to gain additional information on the land use system or to check some of their hypotheses or recommendations for correctness and/or accuracy.

4.1.2. INFORM LOCAL AUTHORITIES

It is very important to **inform relevant local authorities** about your presence and planned activities in their intervention zone and to **obtain their collaboration and support** especially if you intend to bring in visitors from other regions or countries

Ignoring this may lead to trouble. Inquire who needs to be informed clearly explain the purpose of the whole exercise and try to obtain the necessary cooperation. Contacts with local authorities can be quite informal but sometimes a more formal approach may be required and confirmation and arrangements needed in writing.

4.1.3. SELECT FIELD AGENTS/INTERPRETERS

Unless you and the team leaders are thoroughly familiar with the targeted exercise zone, the language and local customs, you will need the assistance from knowledgeable **field agents** and/or **interpreters selected** from the community.

The following are some **selection criteria for a field agent/interpreter.** Educated farmers or their children, or students at agricultural or secondary schools may be of great help.

- **Fluency in the local language**
- **Fluency in the team language**
- **Living in, and knowing the area**
- **Some knowledge about farming/forestry**
- **Pleasant, friendly personality**
- **Not disrespectful to farmer**

Since some of the questions in an interview will inevitably deal with "extension", it may be delicate to select extension agents from a government or non-government service as field agents/interpreters. Extension agents have a vested interest in the answers of the farmers they provide extension services to and may feel that mere interpretation is well beneath them.

Try to involve the field agents/interpreters in all the aspects of the preparation and implementation of the field exercise; farm selection, pre-diagnostic characterization, off farm discussions, plenary sessions. Give them the same information as you give to the participants. Where possible, give them some training and supply them with a list of the more technical or difficult terms that participants may want to use during the interview. If in doubt, test their interpretation skills.

4.1.4. SELECT FARMS/OTHER RESPONDENTS

Conducting a C&D exercise in real life will involve farm selection following certain objectives and principles aimed at avoiding bias in the selection process (random, systematic, stratified sampling, etc.). Similarly a systematic approach to selection of key informants, groups, etc. should be made. In a training exercise, **time is a limiting factor** and for the exercise to be meaningful, the farms to be visited must be as typical on average as possible. It serves little purpose to select two resource poor farmers on the first day of an exercise and to test an agroforestry hypothesis for these on two completely different farming systems on day two. The following main term selection criteria will apply.

- **Willingness to cooperate**
- **Accessibility**
- **Representative of LUS**

The farmer has to agree to participate in the exercise, in randomly selected farms this may not always be the case and thus valuable exercise time can be lost. More time is lost if farms are difficult to access or are very distant from each other. The farms should also be representative of the LUS. Selection criteria for other interviewees (e.g. women's groups, commodity trader) are similar: willingness, accessibility and relative importance to the LUS.

4.1.5. DEVELOP A PROGRAMME

A C&D exercise in the context of a 3 - week introductory training course on "Agroforestry Research for Development" will take 3 to 4 days.

Topics that need to be covered in theoretical or practical sessions prior to the exercise include; an introduction to the concepts of agroforestry, multipurpose trees and shrubs (MPTS), various relevant technologies, research design, land use characterization, diagnosis and design.

The following sample programme covers the various parts (see chapter 1: The "C&D" Training Exercise) of the actual exercise.

	DAY 1	DAY 2	DAY 3	DAY 4
AM	• Part 2 (F)	• Part 4 (F)	• Visit (F)	• Presentations (P)
PM	• Part 3 (W) • Presentations (P)	• Part 5 (W) • Presentations (P)		F= field W= working group P = plenary session

At ICRAF, the teams normally travel to the exercise site on an afternoon. In the evening, the characterization of the land use system, illustrated with a slide series, is presented and the overall exercise is introduced (objectives, methodology, team constitution, logistics).

Part 1, diagnostic tool testing, can be carried out prior to the field exercise and need not to take place in field conditions (e.g. select some people with farming experience at the institution where the training takes place and practice various tools with them).

Parts 2 (data collection and verification) and 3 (hypothesis formulation) could be followed by a plenary session in the evening during which methodological problems encountered are discussed along with possible solutions. After this, a specific problem, and eventually some tools, are chosen by or assigned to each team in preparation of part 4 (hypothesis testing). Assigning different problems and tools to different teams will prevent all teams from working on the same problems and technologies making the final plenary presentations more interesting.

Part 4 could also be followed by a plenary session to present one, or several priority agroforestry intervention(s) that will become the subject(s) for parts 5 and 6 dealing with research design. If several teams present the same intervention(s), the exercise coordinator may assign a different intervention for research design to one or two teams. On the final day, each group presents the results from the field exercise highlighting key features in all five parts. In preparing for this, intermediate plenary sessions could be eliminated in favor of expanding the time available for group discussions. In the absence of intermediate plenary sessions, group leaders will need to meet to ensure some diversity of priority problems and interventions between groups.

4.1.6. ARRANGE LOGISTICS

Logistic arrangements will vary pending prevailing conditions at different exercise sites. Common sense and some experience in organizing training activities will help. Some important points that need to be considered are the following.

- **Accommodation and meals**
- **Transport**
- **Meeting rooms**
- **Audio-visual support**
- **Training stationery**
- **Gifts of thanks**
- **Arrangements with respondents**

Packed lunches taken to the field may help in gaining time and promote informal team discussion. Transport must be adapted to the conditions of the terrain. A meeting room (that can be darkened) for plenary presentations equipped with the usual audio-visual facilities (slide and overhead projection, flipcharts, black or white boards) would be ideal and possibly also some smaller meeting rooms for working group sessions. Participants should also have the usual training stationery both for the interviews (pens, notebooks) and the plenary presentations (overhead transparencies and pens, markers, flipchart paper). The organisers may wish to give farmer respondents a small gift for their participation, such as tree seedlings.

As for arrangements with farmers, take care in setting appointment times. Be conservative to avoid being late and expect some delays on the first day. Also, make it clear in advance that the group would like to interview as many of the household farm workers as possible, not only the head of household.

4.1.7. COMPOSE MULTIDISCIPLINARY TEAMS

This is an important, and not always easy to realize, part of the exercise. True agroforestry characterization, diagnosis and design always require the inputs from many different disciplines and experiences. If some of these are not represented. the outcome of an exercise may be biased and irrelevant to the farming households. A compromise will need to be made balancing the size of a team with the disciplinary and experience representation. Teams of 4-5 participants are considered optimal. Larger groups are more difficult to handle, smaller ones may lose out on representation. In addition, groups should have a team leader with experience in interviewing and a field agent/interpreter. The group may also benefit from the addition of a resource person who might have expertise in a relevant discipline.

Selection criteria for team membership has to consider the following.

- **Discipline**
- **Experience**
- **Gender**
- **Origin**

DISCIPLINE: Ideally each team will have a member with a background in agriculture, forestry, livestock, social and/or economic science.
Avoid teams with purely bio-physical or social-economic disciplinary representation.

EXPERIENCE: Obtain a good mixture of educational and working experiences (research, development, planning, policy making, teaching).

GENDER: Gender related issues will often come up during the fieldwork and the discussions. Where possible, have an equal representation of both men and women in each team.

ORIGIN: It is useful to have teams with different agro- ecological representation. However, depending on language capabilities of leaders and participants, teams may need to consist of members speaking the same language (English, French, Spanish).

4.1.8. SELECT TEAM LEADERS

The role of the exercise team leaders is very important since they will have to guide both the fieldwork and lead team discussions. I The main criteria to select teamleaders are:

- **Discipline**
- **Experience**
- **Leadership**

The disciplinary background of a team leader should complement the disciplines represented by the team. If possible, complementarily in the other team member selection criteria (gender, origin, experience, degree) should also apply.

A good team leader must also be experienced in conducting tile various exercises and be thoroughly familiar with the C&D approach and its application. Experiences in participatory appraisal methods or farming systems research can also be useful.

Finally, it is important for a team leader to have some leadership qualities and group management skills. A C&D exercise offers many opportunities to stray from the main purpose and objectives and the team leader should constantly focus on arriving at a consensus on achieving the exercise objectives and outcomes and on the specific contributions which can be made by each team member. An essential aspect of C&D is bringing disciplines to work together to address the problems of the farmer in an integrated manner. A good team leader should also know how to motivate team members to participate and when to keep quiet rather than take over the exercise.

During the actual implementation of the field exercise, the exercise coordinator can also be a team leader since at this stage coordination activities will be limited.

4.1.9. IMPLEMENTING/COORDINATING THE EXERCISE

Once the above steps and considerations have been taken into account and properly prepared, it should not be difficult to implement and coordinate the exercise in an efficient manner

Time keeping, the organization of the plenary sessions and the distribution of tasks and responsibilities for the different exercises will be the main activities requiring some central coordination and decision making.

Team leaders will be responsible for time keeping within their team, the organization of their teams for discussion and plenary sessions and the execution of assigned tasks for their own team. They will nominate team members to take notes and to report exercise results during the plenary sessions bearing in mind that all team members must participate actively in all the stages of the exercise.

4.1.10. REVIEW AND EVALUATION OF EXERCISE

Exercise follow-up activities deal with thanking all those who have assisted in implementing the exercise (local authorities, field agents/interpreters, farmers, team leaders), a summary write-up of the results of the exercise for overall reporting purposes and future reference as well as to inform those interested in the exercises about the outcome. State clearly that this was an exercise and that care must be taken when interpreting some of the results. Also provide some feedback to farmers, especially if they have requested to receive some information either on the outcome of the exercise or on other subjects.

Finally, the training exercise leaders should conduct an evaluation of the exercise by participants. These are invaluable for shaping and improving future training exercises.

4.2. FARMER INTERVIEWS

Informal interviewing is a common sense art rather than a precise methodology with rigid rules. The key is being natural while guiding the conversation to a fruitful end. This entails being sensitive to the farmers' circumstances, both physically and culturally (Rhoades, 1980). The following are some of tile do's and don'ts while conducting farmer interviews.

DO	DON'T
1. BEFORE THE INTERVIEW	
• **Select an appropriate time (day,** season) for the farmer. Make an appointment and **be punctual**	• Conduct interviews at an **inappropriate time** for the farmer. **Cancel** a farm visit **without informing** the farmer. **Arrive late**
• Upon arrival, **greet** the farmer and others present on the farm	• **Ignore people** present on the farm
• **Introduce** yourself and the members of your team	• **Start asking questions immediately**
• Clearly **explain the purpose** of the visit	• Look or act as if this visit may mean **trouble**
• Create an **informal atmosphere, offer help** when appropriate	• **Damage things!** Trample crops, sample farm produce, cut leaves, fruits or twigs, litter,...
• Ask for a **guided tour of the farm, show interest** throughout the visit	• **Stay around the homestead,** let team **members wander off** or start joking or discussing on their own
• **Observe** and **note things,** ask permission to take notes and pictures	• **Ask obvious questions** about what you can see, **snap away without permission** (especially people)
• Make sure everybody is **comfortable** when conducting the interview	• **Make it difficult** for anybody **to conduct the interview** (harsh sunlight, heat, difficult terrain)
• Be **flexible, relaxed** and **open minded**. Make conversation, talk about the weather, etc.	• Be **rigid** and **business minded** (just the facts please)

DO	DON'T
2. DURING THE INTERVIEW	
QUESTIONS:	
• Ask **one question at the time**	• Ask **several questions** at the same time, let several people ask questions at the same time
• Ask **specific, simple questions** in **a plain and understandable language** (local terms if possible)	• Ask **general questions** and/or use a **highly technical language** (jargon)
• Keep questions **short** (especially when you work through an interpreter) or break them down in **several smaller questions**	• Ask **lengthy questions** covering several aspects at the same time
• Ask **open ended questions**	• Ask **leading questions** or **suggest answers**
• **Probe!** The purpose of the interview is **to diagnose** the farming system	• Merely **"collect" answers** or **tick-off a checklist**
• **Ask a question differently** if an answer indicates confusion or misunderstanding	• Just **accept an answer** if it sounds vague, incorrect or unclear
• **Cross-check later on** if you are not sure about an answer	• **Leave questions unanswered** because you feel that the farmer gives an incomplete or wrong answer
• **Listen!** Let the farmer talk even if at first sight the answer may not directly address the question	• **Interrupt** the farmer or the interpreter or **start side discussions** with other participants
• **Learn!** Farmers live and work in conditions very different from your own, try to understand this	• **Lecture or patronize** the farmer, or be **disrespectful to him/her**
• **Explore** in-depth the issues of importance to the farmer and to the team	• **Ask sensitive questions** (finance, traditional beliefs, family planning, gender issues, ...) unless you feel the farmer is willing to address them
	• **Rush** from question to question in order to cover all the interview topics

DO	DON'T
INTERPRETATION: • Conduct the interview in the farmer's **native language** even if this means the use of interpretation • **Facilitate interpretation** by providing interpreters with all relevant (written) information before the interviews • Make sure the interpreter and the farmer feel **part of a three-way conversation** • Allow the interpreter the **time to properly translate** both question and answer	• Conduct the interview in a language that the farmer is not **fluent** in • **Ignore the knowledge** of the interpreter or **leave him/her ill-prepared** for his/her task • **Leave the farmer** out of the discussion • **Rush or interrupt** the interpreter
TAKING NOTES: • Let different participants **note the** important **points** on different aspects of the farming system or in their own area of interest • **Write up and compare notes** as soon as possible after the interview, away from the farm	• Let everybody write everything down in front of the farmer and create the impression that **"everything he/she says may be held against him/her"** • **Ignore the importance of note** taking and comparing during the discussions later on
3. AFTER THE INTERVIEW	
• **Keep time!** An interview should not take more than one hour and a half but may take longer if the farmer is keen • **Thank the farmer** for the information • **Ask if the farmer has any questions** for the team • **Show your appreciation** for the farmers' time and effort, give a "vote of thanks" • **Provide feedback** to the farmer where possible [copies of pictures, some information he/she requested)	• **Take too much time or continue an** interview if you can see that the farmer is getting restless, bored or tired • **Break-off the interview abruptly** and **leave the farm never to be heard of again**

4.3 PRESENTATIONS

Teams will present the outcomes of different parts of the exercise in plenary sessions. Part one of the exercise book gives information on the **content** of these presentations. The following paragraphs provide some guidelines on **preparing and making them**.

Before embarking on group discussions, each team will nominate one (or several) **team member-rapporteur** who will take notes and present the results of all (or one) exercises as discussed by the group. Draft a rough outline of what will presented and eventually assign specific tasks to different team members. The overall coordination as well as the delivery of the presentation is the responsibility of the team rapporteur.

The most common ways of presenting the results of the exercises will be through the use of visuals such **as overhead transparencies or flip charts,** eventually black or white boards when available. Some teams have used other ways to present results such as role play, drawings or posters. Be original and creative! Capture your audience.

An often made mistake is that teams attempt to make complete write-ups of their results on their visuals. The following text box provides some more hints on how to successfully prepare a presentation using visual supports.

PRESENTATION USING VISUALS

- Follow the **guidelines** for the different exercises to develop the **content** of the presentations.
- **Structure a presentation**: give it a title, an introduction, a body and conclusion (s).
- Limit the information on the visuals to **the important points** you want to make.
- Use **bullet lists**, give additional information on a **separate visual** if needed.
- Make good **speaker notes** that will help you to clarify the bullet points on your visuals.
- **Use a clear numbering system** throughout the presentation, use **a standard template.**
- Visuals should be **simple, clear, attractive, consistent and legible**.
- Use **big lettering** (minimum 10 cm for flipcharts or boards, minimum 1 cm for overhead transparencies).
- Use **lower case** lettering for body text.
- Use **colour** in an organized way.
- **Number** your visuals for your own reference.
- **Rehearse** and **practice** your presentation
- **Speak to the audience**, not to your visuals.

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ICRAF-DSO Training Materials Project

"Characterization, Diagnosis & Design"

Training Exercise Book

EVALUATION FORM

The "Exercise Book"	**STRONGLY AGREE**	**AGREE**	**NEUTRAL**	**DISAGREE**	**STRONGLY DISAGREE**
Is well organized					
Makes the exercise easy to understand					
Makes the exercise easy to implement					
Contains accurate information					
Is easy to read					
Has adequate illustrations					
Has effective illustrations					
Is visually appealing					
Is useful					
Taken as a whole, is a good learning tool					

Rank the 4 main parts of the exercise book in order of their usefulness to the implementation of the exercise (1=most useful, 4=least useful – no two parts can have the same ranking):

THE "C&D" EXERCISE: --------
DIAGNOSTIC TOOLS: --------
CHARACTERIZATION AND EXTENSION INFORMATION: --------
EXERCISE GUIDELINES: --------

A. PART 1: THE "C&D" EXERCISE:

- **Rank the 7 parts of the exercise in order of <u>clarity</u> (objectives, methods, tools, guidelines) for exercise implementation** (1=most clear, 6=least clear, no two parts can have the same ranking):

Part 1: Diagnostic tools use --------
Part 2: Data collection and verification --------
Part 3: Hypotheses formulation --------
Part 4: Hypotheses verification --------
Part 5: Intervention design – Research prioritization
- Development prioritization --------
Part 6: Research design --------
Part 7: Development design --------

B. PART 2: DIAGNOSTIC TOOLS:

- **Rank the diagnostic tools in order of the clarity of their <u>description</u> (definition, types, characteristics, useful hints, examples) for use during the exercise** (1=best, 15=worst, no two tools can have the same ranking)

- **Tick [ ] the three <u>most useful</u> [☺] tools for this type of exercise as well as the three <u>least useful</u> [☹] tools**

DIAGNOSTIC TOOL	RANK	☺	☹
1. Semi-Structured Interview			
2. Farm layout map			
3. Gender resources map			
4. Spatial topographic transect			
5. Historical land use transect			
6. Enterprise calendar			
7. Food availability calendar			
8. Livestock feed availability calendar			
9. Seasonal activities by gender/age			
10. Gender and age division of labour			
11. Benefits analysis flow chart			
12. Farming systems model			
13. Household agroecological system			
14. Cause and effect diagram			
15. Ranking – "Bao" game			

C. PART 3: CHARACTERIZATION & INFORMATION:

- **Tick [ ] the three <u>most useful</u> [☺] parts of the characterization information for this type of exercises well as the three <u>least useful</u> [☹] ones**

	☺	☹		☺	☹
1. Location			**6. Soils**		
2. Climate			**7. Economy & Crops**		
3. Vegetation/zones			**8. Forest Type of**		
4. Field Site			**Northern Thailand**		
5. Major Farm Activities					

- **What bio-physical and/or social-economic information would you like to see added to the characterization information**?

_____
_____
_____
_____

D. PART 4: EXERCISE GUIDELINES:

- **Do you intend to organize a "C&D" exercise in the context of your own training or education activities?** (tick [ ] the appropriate box)
  - ❑ **Yes**
  - ❑ **No**

- **If yes, will these guidelines allow you to organize a 'C&D" exercise?** (tick [ ] the appropriate box):
  - ❑ **Yes**
  - ❑ **No**

- **Also if yes, do you intend to use and/or adapt an "Exercise Book"?** (tick [ ] the appropriate box):
  - ❑ **Yes**
  - ❑ **No**

Use the remainder of this page to formulate any comments, suggestions, ideas,… that you have regarding this "Exercise Book" as training material in support of the "Agroforestry research for development" course: