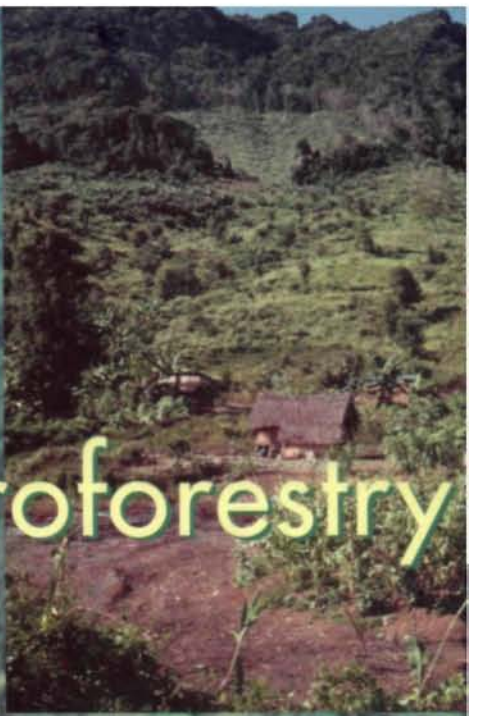
A Guide to Learning Agroforestry



A framework for developing agroforestry curricula in Southeast Asia

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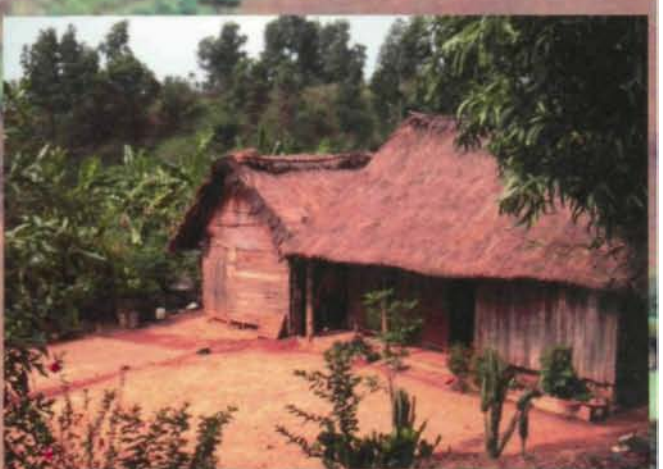
Per G Rudebjer, Peter Taylor and
Romulo A Del Castillo



INTERNATIONAL CENTRE FOR RESEARCH IN AGROFORESTRY

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Training and Education Report No. 51

2001

Southeast Asian Network for Agroforestry Education (SEANAFE)

INTERNATIONAL CENTRE FOR RESEARCH IN AGROFORESTRY

Published in 2001

The Southeast Asian Network for Agroforestry Education (SEANAFE) is supported by the Swedish International Development Cooperation Agency (Sida).

Rudebjer P, Taylor P, Del Castillo RA, eds. 2001. A guide to learning agroforestry. A framework for developing agroforestry curricula in Southeast Asia. Training and Education Report No. 51. Bogor: ICRAF.

Published by:
International Centre for Research in Agroforestry
Southeast Asia Regional Research Programme
PO Box 161, Bogor, Indonesia
Tel: +62 251 625415; fax: +62 251 625416, email: icraf-indonesia@cgiar.org
ICRAF SEA website: http://www.icraf.cgiar.org/sea

Cover photo credit: Thomas P Tomich (background)
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Cover design and layout: Tikah Atikah

Illustrations: Wiyono

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Preface

The backbone of any training and education programme is the curriculum. It is the curriculum that guides the learning events of the course: the aims and objectives, the contents, the teaching and learning methods, where it is carried out, teaching materials and the evaluation of the learning.

Curricula need constant updating to keep up with change and while some subjects, like mathematics can remain rather stable, others change very rapidly. Agroforestry is a very young area of research and education, merely some 20-odd years. The understanding of agroforestry is therefore evolving very rapidly. The field is also complex, because it embraces several traditional sectors: agriculture, animal husbandry and forestry. Agroforestry also contains an crucial element of social sciences—an area that is often weak in faculties of agriculture and forestry.

Curriculum development in higher education has traditionally been rather top-down. But agroforestry in practice is a very applied activity carried out on farms. It must be approached in a participatory frame. This also necessitates more participatory approaches in curriculum development.

Educational organizations in many countries face policy constraints in developing agroforestry curricula, since agroforestry may not be institutionalized, and agroforestry education programmes are therefore in most countries not yet approved by ministries of education. The acceptance and effectiveness of agroforestry education and training will be enhanced if different stakeholders are included in the curriculum development process.

When the Southeast Asian Network for Agroforestry Education (SEANAFE) was formed in 1999, agroforestry curriculum development was a top priority. To address these needs, SEANAFE set to work to develop a guide for agroforestry curriculum development. A regional workshop was organized in Hanoi in November 1999, in partnership with the Helvetas Social Forestry Support Programme, to develop a framework for an agroforestry curriculum for Southeast Asia. The aim was to capture a wide range of experiences, in a participatory curriculum development approach by involving agroforestry teachers and other stakeholders, including employers, NGO's, agroforestry graduates, and others. A series of reviews and national workshops were convened during 2000, as well as a second regional writing workshop, that helped fine-tune the guide.

By publishing this guide, the International Centre for Research in Agroforestry (ICRAF) and SEANAFE aim to provide the foundation for guiding agroforestry learning in Southeast Asia. We aspire for it to be a tool for educational

institutions to address the rapidly changing area of integrated natural resource management.

A large number of people and organizations have contributed in various ways to the completion of this guide. The composition and review of the guide was done by the participants in the two writing workshops. They are listed in the Appendix. The project was conceptualized and implemented by the SEANAFE coordination unit, the Helvetas Social Forestry Support Programme, and scientists from ICRAF's Southeast Asia Program. Administrative and logistical services were provided by dedicated staff teams from these offices. We are grateful that the Swedish International Development Cooperation Agency (Sida) provided the financial support. Finally, we owe special recognition to Tikah Atikah, who did the layout, Wiyono, who illustrated the guide, and to Ann T Papag, Assistant at the SEANAFE Secretariat, and Madah Saskia, Secretary at ICRAF-Indonesia for all their efforts in producing this guide.

Dennis Garrity
Regional Coordinator
ICRAF Southeast Asian Regional Programme

List of Acronyms

AEA	Agroecosystems Analysis
ALCAMS	Agroforestry Land Capability Mapping System
AV	Audio Visual
B/C	Benefit Cost Ratio
CHED	Commission on Higher Education
D&D	Diagnosis and Design
EIA	Environmental Impact Assessment
FSR	Farming Systems Research
GIS	Geographical Information System
HI	Harvest Index
ICRAF	International Centre for Research in Agroforestry
IIRR	International Institute for Rural Reconstruction
IRR	Internal rate of return
KSA	Knowledge, skills and attitudes
LER	Land equivalent ratio
NGO	Non-governmental organization
NPV	Net present value
PCD	Participatory curriculum development
PLA	Participatory Learning and Action
PRA	Participatory Rural Appraisal
ROI	Return on investment
RRA	Rapid Rural Appraisal
SALT	Sloping Agricultural Land Technology
SEANAFE	Southeast Asian Network for Agroforestry Education
SEARCA	SEAMEO Regional Centre for Graduate Study and Research in Agriculture
SFSP	Social Forestry Support Programme
SWOT	Strengths, weaknesses, opportunities, threats
TNA	Training Needs Assessment
UNIBRAW	Brawijaya University

Introducing the guride

Why is this guide needed?

Agroforestry education in Southeast Asia

An increasing number of institutions in Southeast Asia have recognized the importance of agroforestry education as a response to rapid land use change. Agroforestry education and training programmes provide knowledge, skills and attitudes to contribute to the sustainable development of upland and lowland agroecosystems. Many universities and colleges already teach the subject and continue to develop and review their agroforestry courses and programmes. Many others are planning to introduce agroforestry courses at different educational levels.

Agroforestry incorporates a wide range of disciplines, including agriculture, forestry economics, social sciences, human ecology, etc. While agroforestry education needs contributions from many fields of education, most educational institutions are organized sector-wise. New approaches to curriculum development and the teaching-learning process may be required to embrace the multidisciplinary and integrative aspects of agroforestry.

Since agroforestry is carried out mainly by small-scale farmers, the way education is linked to the field is also of great importance. Educational institutions require effective interactions with different stakeholders, including the extension system, community-based organizations as well as the research system.

A study of the status of agroforestry education in Southeast Asia in 1998 pointed out a number of shortcomings in agroforestry teaching and learning (Rudebjer and Del Castillo 1999). A series of training courses and workshops during 1999 and 2000 has confirmed this picture:

- A top-down approach is often applied in both curriculum development and teaching.
- The teaching and learning approaches are teacher-centred, rather than learner-oriented.
- Agroforestry education is often poorly linked to the field and to local communities. The link with research and extension is often weak as well.
- Agroforestry curricula are often inadequate and lack 'minimum standards'. They are often outdated and may lack relevance regarding current approaches to rural development and emerging research findings.
- Many institutions have inadequate resources for facilitating learning and teaching activities, especially a lack of relevant and high quality materials.

The Southeast Asian Network for Agroforestry Education (SEANAFE) decided to address these issues through a regional guide for agroforestry curriculum development.

How the guide was developed

This guide is the result of a collaborative process where members of SEANAFE have drawn on their experiences from agroforestry education, curriculum development as well as agroforestry research and development. During a year-long process SEANAFE organized two regional workshops and a series of intermediate review and testing events to finalize the guide (table I).

In addition, many individuals have contributed with comments on different versions of the guide. ICRAF did the final editing and layout in collaboration with Helvetas SFSP and SEANAFE.

Table 1. Events to develop and test the guide.

Event	Participants	**Output**	Comments
1. Regional curriculum development workshop; Hanoi, Vietnam, 23-27 November 1999	31 participants representing: SEANAFE members, Helvetas-SFSP, NGOs, agroforestry graduates, employers, development projects	First draft of the guide written	
2. National workshop on sustainable agriculture curriculum; Malang, Indonesia, 21-23 February, 2000	Around 35 participants: SEARCA, staff of Brawijaya University, SEANAFE	The guide tested in the development of an agroforestry course for the agriculture programme at UNIBRAW	Agroforestry was considered a key topic for sustainable agriculture
3. National curriculum development workshop, Hanoi, 15-17 March, 2000	15 representatives of 5 universities in Vietnam; Helvetas SFSP; SEANAFE	Development of a detailed framework for a BSc-level agroforestry curriculum, including topics, objectives and contents. The guide was one of several inputs	Feedback received from many individuals; the product has been revised in two subsequent workshops
4. National agroforestry curriculum development workshop, Vientiane, Lao PDR, 23-25 May, 2000	20 participants from universities, technical colleges and training centres in Lao PDR; Ministry of Forestry; SEANAFE	The guide was one of several sources for developing a framework for agroforestry curricula for BSc, Higher Diploma, Mid-level certificate and training courses	
5. National Workshop on Participatory Agroforestry Curriculum Development, Rizal State College, Tanay, Rizal, Philippines from August 30 to September 1,2000	25 participants from universities, colleges, NGOs, government agencies and SEANAFE	Draft framework for a BS Agroforestry curriculum; Recommendations to CHED for policy adjustments	
6. SEANAFE's writing workshop, Bandung, Indonesia, 11-15 September, 2000	12 editors and publishing staff from SEANAFE institutions and ICRAF	Second draft of the guide written; layout and illustrations developed	

Note: UNIBRAW= Brawijaya University; CHED=Commission on Higher Education.

Using the guide

Aims and orientation

The aims of this guide are:

- To provide a curriculum framework to guide and facilitate agroforestry teaching and learning activities in colleges and universities in Southeast Asia
- To serve as a reference tool for curriculum development and reviews in institutions in Southeast Asia
- To help universities and colleges attain their agroforestry education objectives, with particular emphasis on the teaching-learning process

The guide is oriented towards:

- Providing a general guide about the curriculum development process
- Presenting an overview of the contents that should be in focus in agroforestry education. Please observe that users' adaptations to local specific conditions and specific target groups are needed and highly encouraged. The guide is one of several tools in the curriculum development process.
- Emphasizing that practical exercises are essential for attaining agroforestry education objectives

Who can benefit from the guide?

Agroforestry is taught in a wide range of contexts in Southeast Asia, in forestry, agricultural, environmental and social sciences and others. It is taught as full degree programmes, or as a few hours' topic in a related course. It is taught in large universities with ample resources, and in small provincial schools with limited human and financial resources.

There are two main approaches to agroforestry:

- Agroforestry as an integrated part of natural resource management. This includes fields such as forestry, agriculture, animal husbandry, environmental sciences and landscape architecture, as well as economics and social sciences.
- Agroforestry as a 'specialized' field

This guide aims to support agroforestry curriculum development activities in both integrated programmes and specialized ones.

The target group for this guide is obviously very wide. This guide is intended for people who are directly and indirectly involved in the field of agroforestry education. The different target groups (stakeholders) may gain different benefits from using this guide:

- Educators: better prepared curricula—relevant and standardized—and more effective teaching and learning approaches that relate to their own contexts
- Learners at different levels: help learners develop their own learning strategies for agroforestry
- Extensionists: help in applying a participatory process in extension education and training
- Donors: recognize gaps and needs in agroforestry education
- Researchers: help identify research needs and develop appropriate research methods
- Policy makers: recognize gaps and needs in agroforestry education
- NGOs: identify topics and methods for agroforestry education and training
- Communities: recognize their role in agroforestry education and training and raise their interest in collaboration, especially in practical activities

Tips for users

Although different users have different needs, the following are suggestions on how the reader may use this guide:

- Compare the framework in the guide with your own situation related to agroforestry education and identify what is lacking in your existing work.
- Based on your available (or potential) resources for agroforestry teaching and learning, develop your own specific plan for improving the quality and effectiveness of your teaching/learning.
- Interactions and exchange of experiences with different stakeholders will be very helpful. A list of resource organizations in the annexes may be helpful for this purpose.
- Since this guide is generic, further elaboration and local adaptation is needed, regarding contents and especially regarding the practical exercises ('practicum').
- The guide is one of many tools and resources available for curriculum developers. It should be complemented with local information and materials.

Part I—Curriculum development and teaching methods

Chapter 1.

Adult learning and participatory curriculum development

Adult learning

Learning is something which people do all the time; learning often takes place naturally without any help. It is part of the way everyone copes with change. Much learning is unintentional, or 'incidental learning', but a lot of it is purposeful—people can plan their own learning. This means that they can develop strategies, which help them to learn more effectively and more permanently.

Learning is part of the ongoing self-development, part of the growth into increasing maturity and part of the natural pattern of changes throughout a person's life. It comes from an immediate and concrete need. Learning is always an internal matter, which learners do for themselves, but internal learning changes almost always reveal themselves in some form of changed behaviour. The end purpose of most intentional learning is to change one's way of dealing with situations, to do things better. Some learning will of course arise from a sense of interest and this may not always result in behavioural changes, although even here there are likely to be ways in which one's activities will reveal that such learning has taken place. Learning is a process of bringing about changes in one's own self; such learning changes should be more or less permanent; very temporary changes will not really constitute learning.

So, learning can be thought of as a change in response or behaviour which takes place when an individual feels a need, puts forth an effort to meet that need and experiences satisfaction of his effort (Rogers and Taylor 1998). The learning of *adult* learners is self-directed due to their immediate need. They learn faster in an informal and less structured way. This implies a need for more hands-on teaching, more practical exercises, fewer lectures, the use of visual aids, and direct interaction between the learner and the teacher. Farmers tend to learn more if their lecturer or trainer is a fellow farmer, since they speak the same language and have the same experiences and interest.

When dealing with adult learners the teacher or trainer should be learner-oriented and flexible, and the strategy should be varied with realistic examples. Learning styles differ from person to person so the trainer must be able to cope with those differences.

The learner's capacity to absorb concepts is influenced by his or her needs, attitudes and interest. The effectiveness of learning depends upon, amongst other elements, the availability of the needed resources, the type of curriculum adopted and the quality of the teacher.

It has been demonstrated that learners learn more effectively when they undergo an experience, reflect on their experience, draw generalizations and then apply what they have learned. This is illustrated in the experiential learning cycle in figure I below (adapted from Rogers and Taylor 1998). A number of educators have suggested that most learning is accomplished through a process of critical analysis of experience. Learning begins with an experience, and a learner then needs to reflect upon this experience. In some explanations of this experiential process, this reflection is perceived as being rather passive, and more importantly, uncritical. Without critical reflection, learning is unlikely to be effective. For the reflection to be useful for learning, some further inputs may be needed, and the learner needs to search these out, and possibly select from a wide range of information to help in the reflective process. These inputs could be found through dialogue with others, or through media such as books, video, television, radio, etc. Once this has been done, ideas or 'generalizations' may be generated, which means that the learner will construct new learning, hypotheses or theories that can be tested out in reality. This is the basis for action that, in turn, becomes a new experience that can be reflected upon. And so the cycle continues.

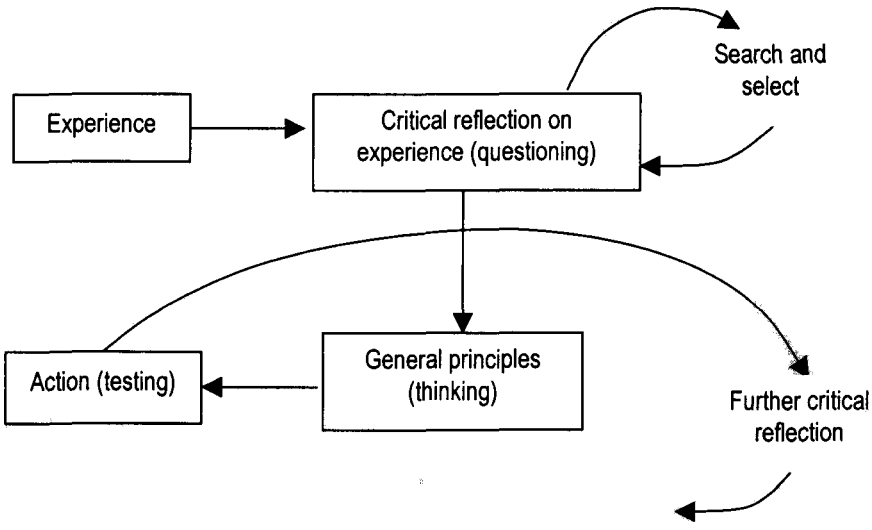


Figure 1. The experiential learning cycle

Participatory approaches in curriculum development

At the heart of all education and training programmes lies the curriculum. This is perceived, frequently, as a syllabus or list of contents. Curriculum development is much more than simply listing the content of a course, however. It takes into consideration the learning the students achieve, the activities and experiences that bring about the learning, the process of planning and organizing these activities and experiences and the piece of writing that embraces this planning. It may be defined broadly as 'all the learning, which is planned and guided by a training or teaching organization, whether it is carried on in groups or individually, inside or outside a classroom, in an institutional setting or in a village or field' (Rogers and Taylor 1998). All three domains of the learning-teaching process—knowledge, skills and attitudes—should be addressed through the curriculum to develop learners' competence.

The curriculum is central to the teaching and learning process, but the degree of autonomy of teachers and even institutions in the development of curricula is very variable. In some institutions, teachers and lecturers are able to make quite wide-ranging decisions on the development of the curriculum, subject to approval from the institutions. In many educational institutions, however, overall development of the curriculum often remains the responsibility of a few, an elite group located at the top of a hierarchy. Discussions on curriculum development tend to involve a small number of 'experts' in senior academic and, in some cases, in government positions, and usually centre on the content of teaching.

There are two serious problems associated with this hierarchical approach. First, there is an assumption that a small, privileged group is aware of the reality of the external environment, and that their own theoretical understanding and experience are sufficient to enable them to develop curricula that will bring about effective learning. Second, there is a perception that learning will take place through transmission of knowledge, and that the subject-related expertise of teaching staff is sufficient to convey knowledge to the learners. Curricula developed using this approach rarely provide guidance to teachers and learners on how the learning process may be facilitated. Teachers are left to fend for themselves, amidst all the constraints that are present in educational institutions. Even in those institutions where teachers have a greater degree of autonomy in the curriculum development process, there is rarely any mechanism or agreed-upon principle for increasing the involvement of other stakeholders. The lecturer or trainer is still considered as the expert, and the assumption is made that he or she will deliver the goods as a result of expertise garnered through professional activities such as academic study and research, or through personal links with the relevant 'industry' in which graduates will be employed. Once again, the minority holds authority over what will be taught to the majority.

As a reaction against this approach, it is becoming widely realized that curricula developed through interaction between persons from different backgrounds can lead to education that is more relevant to the needs, goals and experience of the learners and for society at large. The rationale for this emerges from positive outcomes of participation of different stakeholders in extension and community development activities. Many authors (for example Chambers 1997; Hagmann et al. 1999), have described how participatory processes lead to increased effectiveness in planning, implementation and evaluation of rural development programmes.

In trying to cope with the deficiencies of hierarchical curriculum development, a number of models of curriculum development have been proposed that go far beyond a listing of content to be dealt with in a specified time. One good example is the systematic model by Skilbeck (1984), which outlines five main steps: situation analysis, setting aims, planning, implementation and evaluation. Using a model such as this is very valuable, since it provides a basis for curriculum developers to consider how learning can be made more effective. It is not a blueprint, since each step provides opportunities for a variety of decisions and actions. It places emphasis on the learner, since an important aspect of this approach is the development of behavioural objectives, written in terms of what the learner should be able to do at the end of a given period of study. It also requires an understanding of the external situation or the context in which a training programme is located. It is still possible, however, for this approach to be applied by an unrepresentative minority. Situation analysis may well be invalid if it involves an individual or small group of curriculum developers basing their work on their own narrow perception of external reality. In such a case, there would be a justifiable criticism that the predetermination of learning outcomes, and hence the selection of content, methods and materials, is inequitable.

How is it possible to ensure greater equity, ownership and empowerment in the curriculum development process? These phrases tend, unfortunately, to be used as buzzwords to satisfy the requirements of policy makers, planners and donors. An approach has emerged during the 1990s, however, which attempts to make these ideas both meaningful and practical. This approach has been termed 'participatory curriculum development' (PCD) (Taylor 2000).

Participatory curriculum development differs from 'classical' approaches to curriculum development in two ways. First, in the classical approach to curriculum development, 'experts' prepare the curriculum, which is often endorsed by a central office for implementation in educational institutions. Second, this type of curriculum assumes that learners have common goals, the qualities of teachers are the same and resources are available. Learners tend to be treated as passive recipients, rather than participants in a broader learning process. The knowledge of a few is often valued more highly than the diverse range of knowledge, which is held by a wider group of stakeholders.

Building on lessons learned from field-based practice, a critical, formative element of PCD is the identification of stakeholders, who may include educationalists, researchers, policy makers, extensionists, foresters and farmers. Rather than belonging to a small select group of experts, PCD involves a wide range of stakeholders in a meaningful way, drawing upon their experience and insights in a structured approach to curriculum planning, implementation and evaluation. They may contribute to setting aims and learning objectives, engage in development of the subject matter being taught, and participate in the processes and experiences that lead to the achievement of those objectives (Taylor 2000).

This participatory approach is anchored on philosophical, psychological and sociological foundations of curriculum development. It embraces a holistic view of the development of the learners' personality. It places learning at the centre of the curriculum development process. Achieving this in practice, rather than keeping learning at the level of an abstract, ideological discussion is very challenging. The next chapter shows how it is possible to approach participatory curriculum development in a systematic way.

Chapter 2.

Participatory curriculum development for agroforestry

The participatory curriculum development cycle

As the level of participation increases in any development activity, the situation tends to become more dynamic. Different perceptions and approaches are likely to emerge, which create a need for more flexible, open-ended processes. This is sometimes difficult for curriculum developers to manage; they may feel lost, and unsure of how to proceed. For this reason, it is useful to systematize the curriculum development process to establish a framework for activities. Such a framework is provided by the Participatory Curriculum Development (PCD) cycle, modified from a cycle developed by Skilbeck (1984). This is shown below in figure 2.

The five stages in the PCD cycle follow a continuum, rather than a linear sequence. Further, the stages are linked through a web of interactions and feedback among the various stakeholders. In a large, complex organization such as a university, all of the stages are likely to be going on at the same time. For some discreet training events, such as short courses, however, the sequence of events described in the cycle may be seen very clearly. At the heart of the PCD cycle is stakeholder involvement, for all the reasons described in chapter I. Different stakeholders may have different roles, and there is a need to identify carefully who should be involved in PCD, as well as what their involvement and role should be. In this chapter, each of the stages of the PCD cycle is discussed in more detail, as well as a methodology for analysis and identification of stakeholder involvement.

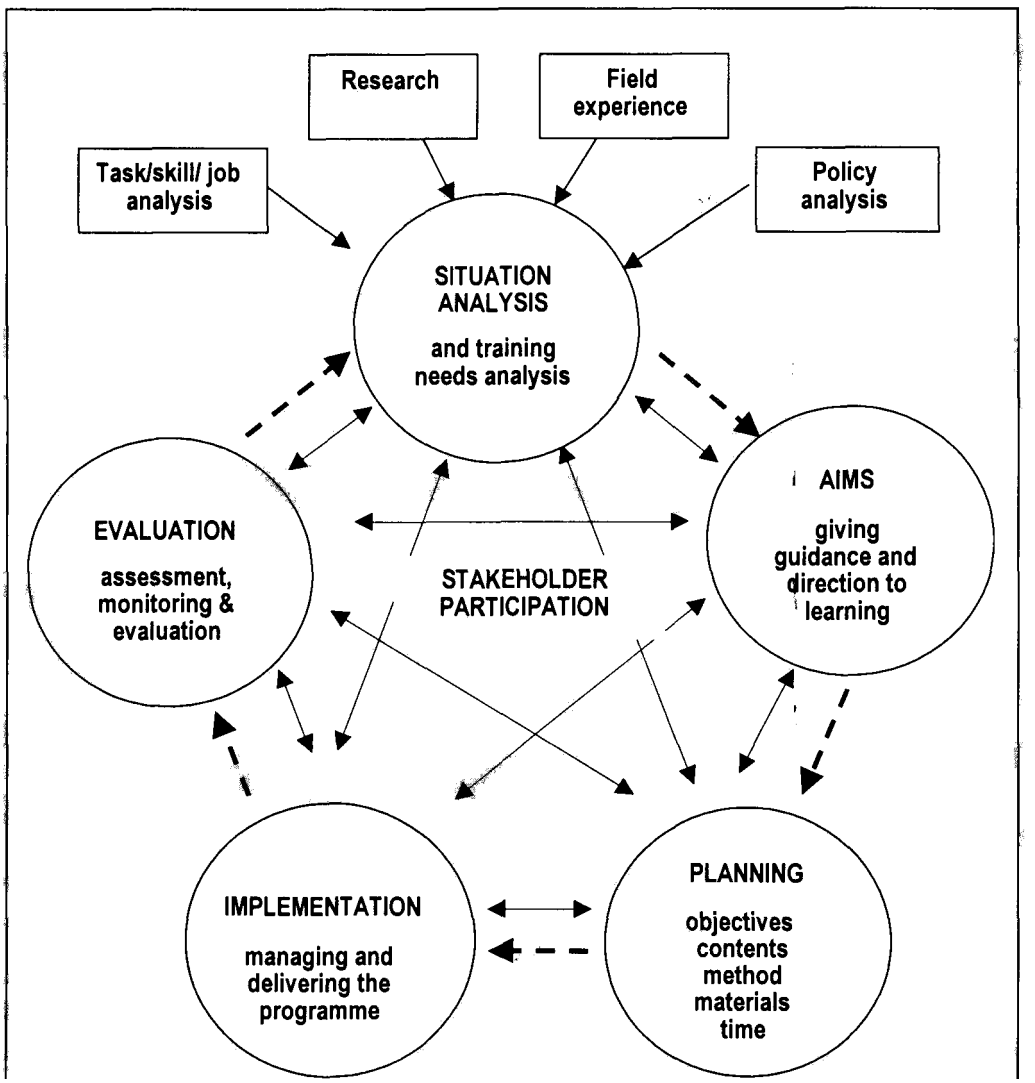


Figure 2. The Participatory Curriculum Development (PCD) cycle.

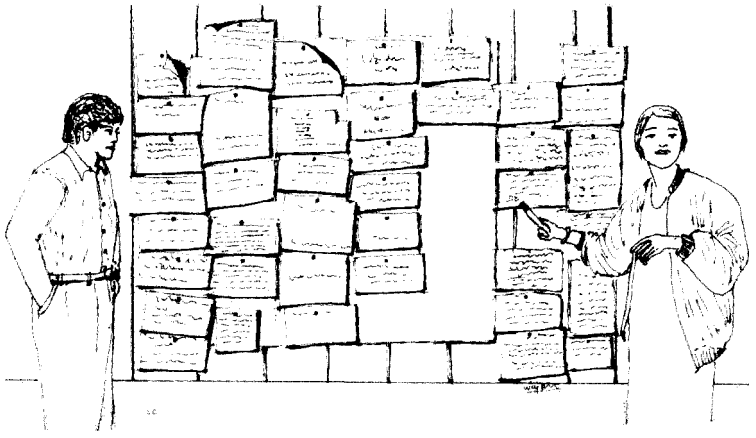
Stakeholder analysis

Since PCD builds on the assumption that participation of stakeholders increases the relevance and quality of the education programme, key questions that arise are:

- Who are the stakeholders in the education programme?
- What are their interests?
- Which role could they play in the curriculum development cycle, given the time and resources available?

These questions can be answered through a stakeholder analysis.

Stakeholder analysis is the identification of the key stakeholders in the curriculum development process. It includes an assessment of their interests, and the way in which these interests are likely to affect the curriculum development process (Rogers and Taylor 1998).



Why do a stakeholder analysis? There are several reasons why a stakeholder analysis may benefit the curriculum development:

- To draw out the interests of stakeholders in relation to the problem being addressed (the 'why factors')
- To identify conflicts of interest
- To identify relations between stakeholders, which can be built upon
- To assess the appropriate type of participation by different stakeholders at different stages of the curriculum development process

Through stakeholder participation, they play an active role in decision making and in the consequent activities that may affect them. Therefore,

- Objectives related to curriculum development are more likely to be achieved
- Curriculum development—and therefore, teaching and learning—are likely to be sustainable

Carrying out a stakeholder analysis

Often, this analysis would take place during a curriculum development workshop. One way of carrying out a stakeholder analysis is described in the following steps:

1. List the names of stakeholders. This may be done in working groups, where the names of stakeholders are listed on cards.
2. Group them into 'outsiders' and 'insiders'
3. Identify their interests in the training (expectations, benefits, resources offered or withheld)
4. Note conflicting interests
5. Highlight relationships between stakeholders (+/-)
6. Assess impact of developing the curriculum/providing training on these interests (+/-)
7. Construct a stakeholder table (figure 3)
8. Develop an 'importance and influence' matrix (figure 4). An easy way is to write the matrix on a large paper, write the names of the stakeholders on cards, and move them around in the matrix until the group agrees.
9. Develop a stakeholder participation matrix, based on the steps of the PCD cycle. This assigns meaningful roles to different stakeholders (figure 5).

STAKEHOLDER	INTEREST	IMPACT OF CHANGE

Figure 3. Matrix for stakeholder analysis.

Importance and influence

The stakeholder matrix helps illustrate the range of stakeholders with an interest in the education programme.

	LOW INFLUENCE	HIGH INFLUENCE
HIGH IMPORTANCE	A	B
LOW IMPORTANCE	C	D

Figure 4. Importance and influence matrix.

Importance indicates the priority that should be given to a stakeholder's needs and interests in the curriculum development and subsequent training.

Influence is the power a stakeholder has over the curriculum development process. It is the extent to which people, groups or organizations are able to persuade or force others into making decisions and taking action.

The importance-influence matrix can be analysed as follows:

- Box A—This group will require special initiatives to protect their interests
- Box B—A good working relationship must be created with this group
- Box C—This group may have some limited involvement in evaluation but is of relatively low priority
- Box D—This group may be a source of risk, and will need careful monitoring and management

. Type of participation Stage in the PCD cycle	INFORM	CONSULT	PARTNERSHIP	CONTROL
TRAINING NEEDS ASSESSMENT				
AIMS				
PLANNING				
IMPLEMENTATION				
EVALUATION				

Figure 5. Stakeholder participation matrix.

The stakeholder participation matrix helps the curriculum developer to analyse the appropriate participation of stakeholders in the PCD process. One factor that has to be taken into account is the availability of time and financial resources. The intensity of stakeholder involvement therefore needs to be adjusted locally to the actual curriculum development situation.

Situation analysis and training needs assessment

Any plan for a training or educational programme should be based on facts and information, gathered in different ways and from different sources. One important source of information is the result of a Training Needs Assessment (TNA). It is important to understand the context in which the training takes place, as well. This may be achieved through research studies or general information gathering exercises, and this process is usually referred to as 'situation analysis'. This analysis takes into account both external (external to the training institution) and internal (within the training institution) factors, which enable curriculum developers to understand the teaching and learning environment.

The situation analysis is conducted to determine whether there is a need to develop, revise or change an educational programme. The situation analysis may involve information from a range of sources, including:

- Task/skills/job analysis
- Research results

- Field experience
- Policy analysis

A range of tools can be used for this analysis:

- Interviews (semi-structured)
- Observations/visits
- Questionnaires
- Analysis of examination and test results
- Evaluation of present curriculum
- Participatory research, including participatory appraisal approaches, such as Participatory Rural Appraisal (PRA), Rapid Rural Appraisal (RRA) and action research, for example Participatory Learning and Action (PLA).
- Seminars and workshops
- Literature reviews and reports

Identifying needs of members of an organization or institution

A training need exists when the application of systematic training will serve to overcome a particular weakness. The three main areas to which the term 'training need' may be applied:

- Needs at organizational level
- Needs at occupational level
- Needs at individual level

At *organizational level,* training needs exist where there are weaknesses in the functioning of the organization itself; it is often difficult to identify these. A very careful situation analysis may reveal them. For example, an extension service may be seen as inefficient because extension workers do not communicate accurate information to the farmers. Providing training, either to the field staff or to the administrators may solve this inefficiency within the organization.

At *occupational level,* certain areas of knowledge, attitudes and skills may be required to perform certain jobs or tasks. These must be identified during the situation analysis (the situation analysis may also include *task and job analyses).* For example, the job description of staff working in the field of agroforestry may be to advise farmers on land use systems; if the field worker has not been trained to do this, then he or she will not be able to perform the task. Training can help to resolve this. Similarly, a trainer in a forestry faculty may never have studied methods of teaching and learning, although he or she has a high level of technical expertise. An analysis of performance of learners and trainers may reveal these weaknesses.

Although it is difficult to cater for *individual needs* when developing a curriculum, these will normally be taken into account during the teaching or training itself, once the curriculum is in use. All learners are different; everyone has a different

style of learning, background, experience, motivation, etc. One of the greatest tasks a course designer face is to build in sufficient flexibility into a course so that the objectives of the course are achieved for all learners. This is another reason why stakeholder involvement is so important at all stages of the curriculum development process.

Identifying training needs of farmers

This is very difficult. Much is written about the importance of doing it, but there is little material available, which describes how it may be done. There are several problems associated with this process:

- Training course developers may not value the opinions of the farmers, thinking that they themselves know best.
- Farmers are suspicious of or intimidated by the training course developers because they think they are really looking for other types of information, or because they have bad experiences of training, which was not useful.
- Farmers are not aware of where their training needs lie, and what possibilities there are for training.
- Discussions on training needs are dominated by certain powerful groups, for example rich farmers, male farmers, at the expense of poor farmers and women farmers.
- 'Farms' are often dispersed over a very wide area, and course developers cannot reach some farmers to discuss their needs. Sometimes it may be difficult to identify what a farm means!

These difficulties highlight the need for a good stakeholder analysis at the beginning of any programme of curriculum development. If all relevant stakeholders are involved in the TNA exercise, the results are more likely to be meaningful and relevant.

For a systematic approach to TNA, the following steps are involved:

1. Organization and orientation of the group tasked to do the TNA
2. Preparation of the materials
3. Validation of the materials
4. Dry-run/pilot testing
5. Identification of organizational, job and individual needs (participatory)
6. Data gathering
7. Classification and tabulation
8. Analysis and interpretation
9. Presentation of the results to the stakeholders
10. Integration of suggestions from the stakeholders and finalization
11. Implementation of the intervention

Carrying out the research

There are many methods used to gather information for curriculum development purposes. The approach, the method, and the tools used will depend on the nature of the information sought, and the purpose for which it will be used. It may also depend on the role and contribution of different stakeholders in the PCD process. Generally, research is divided into two types; quantitative and qualitative. Quantitative data deal with numbers, trends, and highly objective information. Qualitative data may deal with perceptions, opinions, observations and more subjective information. Statistical treatment of quantitative data tends to be more straightforward and provides concrete information, but qualitative data may provide a deeper understanding of a complex situation. Most research uses both quantitative and qualitative methodologies; a combination of the two is called 'triangulation' because it allows a situation to be explored and interpreted from different perspectives and viewpoints. This is very important in curriculum development, where an understanding of attitudes and beliefs is just as important as a compilation of numbers of employees or lists of tasks and duties associated with a particular job.

Interviews and surveys

Interviewing and use of questionnaires are very common techniques used to gather information for curriculum development purposes. A survey instrument needs to be very carefully developed, however, or it may lead to the collection of inappropriate information, and ultimately to invalid conclusions. For this reason, the validity of a research instrument should be checked at the levels of appearance ('face') and content. Face validation considers the actual appearance of the instrument, its indention, size of the letters, type of paper and also the vocabulary used. The terms used must suit the level of the respondents and if they cannot understand English it may need to be translated into their local language or dialect. Content validation on the other hand, refers to the adequacy of the items/statements in terms of what is to be evaluated, measured, or explored. A valid instrument measures what it is supposed to measure. This is different to 'reliability', which is a gauge of the consistency of data collected during multiple uses of an instrument. A research instrument may be reliable but not valid, and vice versa.

Both questionnaires and checklists are commonly used to gather data and information. If these are structured, they should contain all the statements needed to extract information from the respondents, classified and arranged logically, according to the information required. The statements should not be confusing. Questionnaires or checklists to be filled in by the respondent should only be used when they are literate. If respondents are illiterate, an interview schedule could be used.

Sometimes, a highly structured questionnaire is not appropriate, as it does not allow new lines of thought to be explored as they emerge in a discussion.

Semi-structured or unstructured interviews are very useful when it is important to learn about a new or complex context. Many researchers find interviewing quite difficult. However, there are some basic procedures and guidelines that could help in planning the interview:

- An introduction and an explanation of purpose are vital
- Start with general questions describing the current situation; it is easier for informants to answer and gives a context and opportunity for focus.
- Be careful with very 'big' questions like: 'what do you need to learn?', as such questions are very difficult to answer, and it is very difficult to analyse the response.
- Develop a dialogue
- Be observant
- Use open questions (who?, where?, what?, when?, why?, how?). You should not use too many questions starting with 'why?' (That is, don't put too much pressure on the interviewee).
- Use simple language
- Ask one question at a time
- Start with broad subjects and then concentrate on more specific topics
- Avoid leading questions
- Probe for deeper understanding
- Do not 'supply' answers
- Do not 'lecture'
- Be prepared but be flexible
- Be clear about the reason you are interviewing a person or a group. Are you interested in their training needs, or their opinions about the needs of others with whom they have a relationship?
- Remember you have to analyse the data. Try to organize your notes/records in a simple way. Use a checklist or tables to help record data and analyse them later.
- Keep an open mind. Some information will be needed for later use; other training needs will emerge, which you can consider in the future.
- Use methods (especially participatory methods), which can address several questions at once. This helps to relate issues in an integrated way and can be more meaningful to respondents. It can also raise new questions that were not thought of earlier.
- Use secondary data when possible to avoid gathering information already available; but it is good to double-check accuracy/ validity of secondary data—often statistics are out of date or faulty.
- The answers to some questions do not lie in the domain of some informants. Identify appropriate informants for the appropriate questions.

The art of interviewing is rather like the art of good conversation, so remember to:

- Be polite
- Be sensitive
- Introduce yourself and explain why you are here
- Thank people after finishing

If you follow these rules, then you should at least be welcomed back in the future!

Content of the interview

Some basic information is usually offered and collected at the beginning of an interview:

1. Introduction
   - Introduce yourself (name, position, office...)
   - Purpose of the interview
   - Timing and planning
2. Personal information about the informant
   - Name of the informant
   - Age
   - Sex
   - District (or equivalent)
   - Village (or equivalent)
3. Educational/professional background of the informant
   - Qualifications
   - Training courses attended
   - Work/professional experience (years/level)

The interviewer should inform the persons to be interviewed in advance as to the purpose, place, time and duration of the interview. The interviewer should only record what he or she sees and hears. Tables or checklists can be used to facilitate recording. Questions should be asked clearly, if necessary repeated or clarified.

Combined methods

Another approach in data gathering is the combination of questionnaire/ checklists and focused discussions. In this case, after providing information through a questionnaire or individual interviews, the respondents are convened/gathered and questions are asked to gather information, which cannot be extracted from the instrument and also to cross-check or validate the results. The moderator asks questions based on the questionnaire. The responses of the group may be recorded with the use of a cassette and the

recorder will transcribe all the responses to support the information from the instrument.

There are very many other ways to gather information, of course. As mentioned above, participatory research can contribute greatly to the curriculum development process. Many teachers and trainers are also involved in field-based activities, such as extension, field-based training and community development. These experiences are a rich resource for curriculum development, as ultimately the purpose of a TNA is to identify the key sets of knowledge, skills and attitudes required by learners to enable them to perform effectively in their job or work.

Participatory data analysis and interpretation

The data collected after classification and tabulation should be returned to the respondents/interviewees for validation. If appropriate, the validated data should be subjected to appropriate statistical tests/mathematical computation and interpreted. After reviewing the interpretation, the results should be presented to the different stakeholders for confirmation, followed by finalization and dissemination.

The results of the TNA will then be analysed in the light of other data on the external and internal environment in which the education or training programme takes place. The results will form the basis for setting the aims of the education or training programme.

Setting the aims and objectives

To plan a curriculum effectively, it is necessary to gain agreement from stakeholders about the orientation of a programme of learning. This can be expressed through written *aims,* or broad statements of purpose, which guide the direction in which a programme of learning will take place. The aim(s) of a course should reflect the needs and reality described through the TNA and situation analysis. It should be possible for stakeholders to clearly identify the link between the needs identified and the aim. An aim responds to the question 'why are we providing this training? Normally, an aim is written in terms of what the programme (and therefore the teacher) intends to achieve. For example:

> *'At* the *end of the course, the students should be able to explain satisfactorily the basic philosophy, concepts and principles of agroforestry'.*

Once the aim (aims) of a course has (have) been defined, the next step is to gain agreement on the range of *knowledge, skills and attitudes* (KSA), which learners need to develop as a result of a programme of learning. Once again, stakeholders should have identified these KSA during the TNA and situation analysis. This set of KSA should then form the basis for the development of the

curriculum, and in particular, as the basis for the learning objectives or outcomes.

The *learning objective* or outcome is a statement of what students will be like or what they will be able to do after successfully completing a given course of instruction or being exposed to a given learning experience. They indicate the type of change, which stakeholders believe the learners should undergo. Of course, in a PCD approach, the view of the learners about the nature of this change is of critical importance.

Many teachers and trainers plan their teaching in terms of what they will do themselves. The basic principles of adult learning demonstrate that this approach is likely to be ineffective, as teachers cannot 'learn for the learners'. Only the learners can bring about change in themselves. Learning objectives, therefore, are written in terms of what learners should be able to do after a period of learning has taken place.

There are many debates about how specific objectives should be. Some educators believe that learning can only be measurable if a specific behavioural change is predicted prior to a period of teaching. Others feel that it is unrealistic and controlling to decide on behalf of others what behaviours they should develop. In a PCD approach, stakeholder agreement at this point is, therefore, critical. As a general guide, curriculum developers should try to ensure that objectives or learning outcomes are responsive to identified needs, and that they

- are written in terms of the learner
- identify a desired behaviour by name (using a verb)
- state the conditions or restrictions under which the learners should demonstrate this behaviour
- include criteria or standards indicating the level of performance of a behaviour or how the behaviour will be demonstrated

The acronym 'SMART' is a useful guide for teachers and trainers. This means that learning objectives or outcomes should be:

- specific
- measurable
- attainable
- relevant
- time-bound

By using this approach to curriculum development, the learning is centred on the experiences and behaviour of the learner, rather than those of the teacher.

Planning the curriculum

Realistic planning

Curriculum planning has, traditionally, been an activity carried out by a few educators at the 'top' of the education system. The PCD approach is based on the involvement of a wide range of stakeholders in the curriculum development process. There are many benefits from this, including increased opportunities for networking, reflection and discussion, and the possibility to create a dynamic, flexible and sustainable curriculum development process. It can be expensive in terms of time and resources, however, and there may be logistical difficulties. Some stakeholders may have unrealistic expectations that cannot be met. It is also difficult to create a mechanism by which different stakeholders can work and interact on an equal basis, since they may have different perceptions, experiences, educational backgrounds and a different understanding of the wider curriculum development process.

For these reasons, it is important that the planning phase is realistic. The curriculum developers should consider carefully when and where different stakeholders could contribute most effectively (as indicated through the stakeholder analysis). They should also encourage stakeholders to prioritize different elements of the change process through the creation of realistic action plans, to which the various stakeholders show commitment, sometimes through formal or semi-formal agreements. This will make the allocation of resources more effective, and reduce the chance of failure due to over-ambitious planning.

Choosing and sequencing the content

Based on the learning objectives or outcomes, the content of the curriculum should be selected and sequenced. It is impossible to include all contents related to the learning outcomes; stakeholders will often disagree on which content is essential, which is useful, and which is simply interesting. The stakeholders should be encouraged to focus on the learning outcomes and then to decide the following:

- Which knowledge, skills and attitudes MUST the learners acquire (without these, the learners will not be able to attain the learning outcomes)?
- Which knowledge, skills and attitudes SHOULD the learners acquire (these are important, but they are not essential to attaining the learning outcomes)?
- Which knowledge, skills and attitudes COULD the learners acquire (these are interesting, and may enrich the learning process, but are not essential, nor particularly important)?

Once all the knowledge, skills and attitudes have been selected, it is necessary to organize them into a sequence. When sequencing the content, based on the experiential learning cycle, four basic rules should be followed:

1. Move from the simple to the complex
2. Use an existing logical organization. This may be chronological, topical or dependent on learning styles
3. Move from the known to the unknown
4. Cover the content in the order of job performance

Having completed the selection and organization of the content of the course, the materials and methods should be selected.

Selection of methods and materials

The very nature of agroforestry demands the acquisition of a wide range of knowledge, skills and attitudes in learners. If learners are to be empowered, they must be able to organize their own learning, and not just be 'empty jars' to be filled up. When considering which methods and materials are most suitable for a programme of learning, it is important to decide early on about what the trainer will do, and what the learners are expected to do. It is very common to find trainers standing in front of a blackboard or overhead projector, or standing in a field and talking to/at the learners. Modern educational theory suggests that the more involved the learners become in their learning, the more likely they are to learn. This is especially true for adult learners, who already have a wide range of experience.

This suggests that learning is a participatory process where the role of the teacher or trainer is *facilitation,* not *indoctrination.* Development and selection of appropriate learning methods and materials, therefore, often become a daunting task for teachers. Learning methods and learning materials are both dealt with, later in this section, and suggestions for methods and materials are also provided in the sections that deal with specific agroforestry topics.

Planning evaluation

In addition to planning learning outcomes, contents, methods and materials, the curriculum developer should also gain agreement with stakeholders on how the evaluation process would be organized. Curriculum evaluation is considered later in this guide, but preparing for evaluation is an essential part of the curriculum planning process, and stakeholder involvement in evaluation should be agreed upon during the stakeholder analysis.

The curriculum framework

There are many ways of setting out the basic framework for a curriculum, and this guide cannot do more than remind the curriculum developers that all the components discussed in this section on planning should be incorporated into the curriculum framework. This will ensure that the curriculum is more than a syllabus, which is often simply a list of contents. One example of a curriculum

framework is provided here, but this can be adapted to suit any particular institutional context.

Developing a scheme of work

The most common way to organize the delivery of the curriculum is to draw up a scheme of work. This is the sequencing of the topics and activities over a given period of time, for example, one month, six months, a year, a term or a semester. The scheme of work will complement the written curriculum and is a planning tool for teachers. It should always be developed in the local context, because the timing of key learning events for agroforestry education will depend on local conditions such as seasonal activities, climate, patterns of cropping and livestock management, festivals, etc. It should also take into account the demands on time of key stakeholders (teachers, students, resource persons, farmers, etc.) and the various opportunities and facilities available for practical work. Also the timing of practical activities should complement the more theoretical components of the teaching programme, to ensure that students have an opportunity to reflect on theoretical concepts and principles, and to practise, experiment and explore these in an active way, whenever possible in the 'real world'.

Example of a curriculum framework

Title of course: Agroforestry
Timing: 40 hours
Location: Department of Forestry
Participants: BSc Forestry, second-year students

Aim(s) of the course:

- Support the development of agroforestry in rural areas
- Equip students with knowledge, skills and appropriate attitudes regarding agroforestry as an approach to integrated natural resource management
- To enable students to facilitate agroforestry development in a participatory way, in various ecological and socioeconomic situations

Topic	Learning outcome: (By the end of the course, participants will be able to:	Content	Methods	Materials	Timing	Person responsible
1. Introduction (5 hours)	Explain why agroforestry practices are relevant for developing rural areas and for sustainable management of natural resources Characterize rural land use systems and recognize and analyse current land use issues Identify common agroforestry practices and options	Overview of land use systems in the country Main land use issues: slash-and- burn cultivation; upland migration; rural poverty; sustainable development Agroforestry potential to address land use issues	• Lecture • Group work: students' own experiences of different land use systems • Field visit to nearby watershed	• Slide series on land use systems • Video on agroforestry practices • Handouts	• Lecture: 1 hour • Field visit: 2 hours • Group work: 3 hours	
2						
Etc.						

Evaluation procedure: Written examination by the end of the course (50% weight); field exercise reports (50% weight)

Implementing the curriculum

Pre-testing and flexibility

Even if the preceding steps in curriculum development seem to have been effective, the implementation phase is really the 'moment of truth'. Implementation will always reveal the strengths and the weaknesses of the curriculum and of the process by which the curriculum has been developed. New curricula, or newly revised curricula, which are likely to have wide institutional implementation, are sometimes pre-tested in different contexts before they are more widely adopted. Different stakeholders may then give feedback on the effectiveness and efficiency of the learning brought about as a result of the programme of learning. A PCD approach favours flexibility, however, and wide-ranging adoption of a specific curriculum means that, in practice, many stakeholders will not be involved directly. This is one reason why this guide is not seen as a blueprint for a curriculum for agroforestry education, but rather as a helpful tool, which will help users to develop curricula built on a strong philosophical and conceptual foundation and suited to the local context and field reality. The opportunity should always exist for experiences and learning points emerging from the field and other sources of information to be incorporated into the curriculum development process.

Lesson planning

The user of the curriculum (who, in a PCD approach, should have been intensively involved in the curriculum development process) will be guided by it, and also by the scheme of work. There is a need to plan during the implementation phase as well, because it is often difficult to translate the planned curriculum into reality in the intense and dynamic environment of a classroom or a field situation. One way to do this is to develop a 'lesson plan' for each lesson; this practice is highly recommended for teachers who are new to teaching, or who are implementing a new or revised curriculum for the first time. A lesson plan is a detailed description that covers:

- The class you teach (year, number of students), what subject and topic, when the lesson will be held
- The main aim of the lesson (what you hope to achieve)
- The main objectives (what the students will be able to do by the end of the lesson)
- A breakdown of the lesson into different elements. This may include the introduction of the lesson, during which you should find out the prior knowledge of the students; the presentation of the main theme, perhaps a demonstration or a practical activity for your students; and a conclusion. Allocate time to each element to make sure it fits into the lesson.
- A list of the methods you will use in each part of the lesson
- A list of the materials you will need for each activity
- A guide to how you will evaluate the learning in the lesson

After the lesson, it is a good idea to make notes that describe how the lesson went—what worked well, what could be improved and what you could do better or differently next time.

Modes of and criteria for evaluation need to be formulated very early in the process of curriculum development. What are the indicators of achievement? Have there been any changes in knowledge, skills and attitudes (KSA)? If so, to what extent? What factors contributed to the results? How can these be used to improve the curriculum and classroom delivery?

Example of a lesson plan

Title: Observing the distribution of tree roots in a soil profile
Location: Beside road outside the institution
Duration of lesson: 45 minutes
Aim: To study a plant root system and its association in a soil profile
Objectives: By the end of the lesson, the students will be able to

- Explain the structure of the tree roots and other vegetation around the tree, and their distribution in the soil profile
- Explain how the tree-vegetation root system contribute to soil conservation as well as its effectiveness in nutrient uptake
- Describe the general pattern of tree roots
- Describe the apparent characteristics of or competition of the plant root associations
- Recommend strategies to optimize plant root associations
- Apply this knowledge of rooting systems and distributions in manipulating mixtures of species in the agroforestry system

Key points	**Resources**	**Method**	**Time**
Introduction • Link to previous lesson on below ground tree-crop interface, role of roots • Soils: show plant root systems and their vertical distribution; roots of trees and grass occupying different soil layers; trees do more in deeper layers; association of various rooting systems help stabilize the soil. • Four patterns of vertical distribution of tree roots may be observed: 1. High concentration in the top soil (0-10 or 0-20 cm) and a negative exponential decrease with depth, sometimes rapidly 2. A linear decline with depth 3. A more or less uniform concentration over the top 1 m 4. A maximum concentration somewhat below the topsoil • Tree roots play an important role in the uptake of water and nutrients from the deep soil; in the capture of the nutrients from the soil solution; and in the enrichment of the soil with organic matter and nutrients. • Set against the above benefits are the negative effects of tree-crop competition by roots	Poster display of four patterns of tree-root distribution with soil depth from previous lesson (Young 1997) Below ground tree-crop interface Measuring root zone in the soil profile	Presentation of posters with visual aids Explanation and evaluation of the root zone Warning about the need for safety beside the road	15 minutes

Continued

Example of a lesson plan (continued)

Key points	**Resources**	**Method**	**Time**
Development • Demonstration of a tree root pattern in the soil profile • Appearance and value of the tree roots in soil conservation • Association of tree roots and other vegetation showing niches of different plant roots, and complementary and competition effects • Selecting strategies in minimizing competition in the tree-crop interface: 1. Select a tree with complementary root distribution to crops or low competitiveness 2. Manipulate the tree roots by pruning and trenching and by using barriers or tillage 3. Reduce the length of the tree-crop interface 4. Use rotational agroforestry systems	A 'ready-made' soil profile presenting the tree roots distribution—a bank beside the roadside outside the institution	Take class outside to roadside. Demonstration of the different layers in the soil profile showing tree roots associated with other vegetation. Group discussion.	20 minutes
Conclusion • Review of main points, referring to objectives • Link to gardening practical the following day	• Classroom	• Return to class • Question and answer session	10 minutes

Note: [Here you can add any additional information that is important, for example, follow-up to the next lesson, special safety precautions, etc.]

Methods: Learning and teaching strategies

Introduction

A challenge for the agroforestry teacher and curriculum developer is to equip the students with effective and suitable teaching and learning strategies and approaches. This is particularly important for complex, community-based natural resource management, where 'systems-thinking' is the key.

Many agroforestry students themselves will later take on a role as trainer for farmers and extension staff, or for new generations of students. The choice of learning and teaching strategies therefore serves the double aim of providing knowledge and skills, and equipping the students with attitudes and approaches that will serve them in their future working life.

The four main factors to consider when selecting methods for teaching and learning are

- Learning outcomes: List all the possible methods that could be used to allow achievement of the objectives or learning outcomes
- Content: Narrow down the list to ensure the content is adequately covered
- Learners: Consider their needs, capabilities, etc. This will reduce the list further.
- Resources: This will determine the final selection of methods to be used, since there is no point in choosing methods that cannot be implemented

Methods and experiences

Examples of methods include: lectures/presentations, group discussions/group work, brainstorming, demonstration, reading, exercises/problems, case study analysis, role play/simulations, games, practical exercises, project work/research, field visits, attachments. In addition, the following teaching-learning methods and experiences can be used to expose the students to a wide range of disciplines:

- Thematic multidisciplinary seminars, to expose learners to cross-disciplinary issues and interactions
- Guest speakers, to provide disciplinary perspectives and summaries of disciplinary contributions
- Problem-oriented workshops, to deal with and resolve real-world problems through focused case studies
- Teacher-accompanied participation at government agency meetings, to expose learners to public participation in the policy process and the operational reality of the government
- Observers at village-level planning sessions, to expose learners to local-level planning and also the functioning of democracy (decision making) at the grassroots' level

- Village- or farm-based practical exercises ('practicum') to gain understanding of the complexity of farmers' reality, decision making and strategies
- Weekend village residency, to engender empathy and cultural sensitivity
- Video-recorded role playing for reviewing and discussing the dynamics of group interactions, attitudes and skills related to real-life situations
- Student seminars incorporated into courses

Lecturing as a teaching method

Pure lecturing is a one-way communication process. It is the teacher's spoken message. The message is moved from the sender to the receiver in a one-way direction. Despite this limitation, the lecture when well prepared and presented, can stay in the memory for a long time. The lecture is a very effective and economical method of transferring information to a big group or when there is a need to present a large number of items of information in a short period of time. However, it is unsuitable to use it for teaching skills or very detailed issues.

The lecture when delivered by a skillful speaker can raise interest in the subject and leads to a more comprehensive research into the contents. It may cause the listeners to consider themselves as members of a group and having a role in it.

The subject matter must be divided into logical parts of the correct size. Since the capability for receiving information is limited, the lecture must be clear and it must emphasize the main points. Also the lecture must be in a logical sequence to help the listener follow and understand the content properly.

The teacher may enrich his/her presentation by the use of illustrations on the board or transparencies or slides with the aid of the overhead projector. A lecture can also be combined with any other teaching method like demonstration, questioning or practical training to make it more effective.

Box I. Structuring a lecture.

Possibilities for structuring a lecture:

1. The classical method—divide into broad sections, sub-sections and perhaps again in smaller units.
2. The problem-centred method—useful for examining alternative views and solutions to problems. It contains a statement of a problem's explicit and implicit criteria.
3. The sequential method—consists of a series of linked statements, which usually lead to a conclusion. The teacher has to both ensure that the steps are within the grasp of the students and frequently summarize the main steps and the procedure.
4. The comparative method—compares two or more processes, themes, stories, ideas or systems. It may be a search for similarities or differences, for advantages or disadvantages.
5. The thesis method—This begins with a hypothesis and proceeds to justify it by bringing together a wide range of evidence and arguments that may be presented in major sections or in a problem form. It may include theses or counter-theses.

Presenting a lesson

Part of every lesson will involve presenting information to students. It is easy for this to become boring. If the teacher talks to the students for a long time (certainly more than 10-15 minutes) without involving them actively, students are likely to lose concentration. The following tips can help motivate and interest students when the teachers present information:

- Start the presentation by finding out what the students know about the topic already; ask questions which do not require only a 'yes' or 'no' answer.
- Ask the students why they think they should learn about this topic—this can help them have some input into the aim and objectives of the lesson.
- Try to relate the topic to what the students are familiar with, either from a previous lesson or from their own experience; the teacher may use examples, which they will find interesting.
- The teacher SHOULD NOT try to cram too much information into a short time period; some of the students will not take it all in.
- Remember that every class contains a group of individuals, each of whom has his or her own way of learning and personal interests; try to be aware and meet the needs of each of the students (of course, this is difficult in very large classes).
- Use a range of different visual aids whenever possible; the blackboard (or whiteboard) is very useful, but try to use posters, pictures and real materials if available; these create interest.
- Encourage the students to actually become involved with the lesson material; use demonstrations; let the students touch, smell, observe and draw the items under discussion; remember that 'doing' leads to 'understanding'—students will forget most of what they hear, and a lot of what they see.

- Give the students a chance to take notes, either during the presentation, or immediately afterwards; the teacher could do this by dictating, or by writing notes, neatly, on the blackboard. Students should also be encouraged to write their own, original notes, which are the main points of the discussion, but this requires maturity and good language skills; once again, find out about the ability of the students as soon as possible.
- Ask the students to take some responsibility for their own learning; encourage them to undertake projects, keep diaries, look for information from newspapers and books, listen to interesting information on the radio, or the television where available, and observe the farming practices of their families and neighbours.
- Try to observe the reactions of the students—this becomes easier as the teacher gets to know them, and ask questions regularly, sometimes of all students, and sometimes of particular individuals; it is very helpful to know and address the students by name, as this will help the teacher to build up a good relationship with them, and it will increase their attention!

Questioning as a teaching method

Questioning is used to direct the students' attention to a problem and its solution, thereby stimulating creative thinking. It is the most widely used teaching method that directly involves activity of the students and it certainly enhances learning. The main or key questions (related to the learning outcomes for the lesson) that the teacher should ask must be thoroughly prepared in advance by the teacher when planning the lesson and the students must be given enough time to think and experience the joy of finding solutions. Preparation is important, but it is not the end of the story, however. There is always room for additional or follow-up questions, depending on the answer or the discussion, and the ability to facilitate discussions depends to some extent on the creativity and flexibility of the teacher.

One particular approach, known as *'brainstorming',* encourages the learners to respond quickly and freely to an initial question. In this case, all responses are accepted, there is no 'right' or 'wrong' answer, and all answers are written for everyone to see. After a period of time, the session continues with a discussion of the range of answers, and perhaps categorization or further development of ideas that have emerged. Again, for this type of activity, the facilitation skills of the teacher are very important, but the type of question asked initially will have an important effect on the success of the method.

Types of questions are given below:

- Knowledge questions. These aim to discover whether the students remember certain specific facts or not, for example:

- What are the most common indigenous tree species in the Philippines?
- Name the most economically important farm animals in Lao PDR
- What are the main reasons for farmers to practise slash-and-burn?

- Comprehensive questions. These are used when the teacher is trying to find relationships between different things and organize them so that they are in logical order. It sometimes requires students to translate ideas from one answer to another, for example to interpret a graph:
  - Compare the profitability of agroforestry on farms in Sumatra and Java
  - Using the table of plant counts made between the years 1990 and 2000, name the dominant tree species in Thailand

- Application questions. These require the students to apply a certain rule, process or phenomenon to a particular situation: He or she must be able to see the logic in an unclear situation and realize how the general rules are applicable. In mathematics, these questions are common. For example
  - If $x = 2$, $y = 5$, what then is $2x + 2y$?
  - Give an example of the use of the law of supply and demand in timber tree production

- Analysis questions. These require critical thinking from the students to be able to analyse the situation for different reasons:
  - To identify motives, reasons and causes of a specific occurrence
  - To consider and analyse available information to reach the right conclusion
  - To analyse a conclusion, interface or generalization based on evidence

  Examples of analysis questions:
  - What is your conclusion about the causes of environmental degradation?
  - Explain the phenomenon of global warming

- Syntheses questions. These are used when students have to form relationships between different factors and arrange things in a logical order in a new or original way. Examples of syntheses questions:
  - What would happen if the price of crude oil continues to rise in the world market?
  - What would be the consequences on market prices of a greater supply of tree products grown on farms?

- Evaluation questions. Used when students have to evaluate and learn to choose among alternatives by judging what the best solution to a particular situation is. These questions can also be used to ask the students to offer their opinions and give their reasons. Often, there is not just one correct answer but different possibilities are acceptable, as long as they are logical and the reasons are explained, as in the following examples:

- Read this statement (Note: Teacher should provide). Are you in favour of this or not?
- Why?

Box 2. Planning questions as a teaching method.

Tips in planning questions:

- The question must be clear
- The question must be challenging
- Ask only one thing at a time
- Deliver questions evenly to students
- Take into account the individual differences of the students
- First ask the question—and only after a while, name the student who is to answer
- A good question leads the story forward
- Questions should not be asked for punishment
- Give praise for a good response

Providing a demonstration

Presentations are a good way for the teacher to provide information effectively, but there is always the danger that the students will not remember much of what the teacher says. Information that is only heard is often forgotten. The teacher can increase the likelihood of the students' remembering and understanding by providing demonstrations. These can be done in the classroom or outside in the farm or field, and they involve the teacher or another person performing a technique under real or simulated conditions. Because the students may not only hear, but also see, and perhaps touch and smell as well during the demonstration, it is a very motivating form of teaching, and can encourage learning very well.

Demonstrations in agroforestry teaching are especially important because agroforestry involves much practical activity, and the students should have the chance to develop a range of practical skills as well as theoretical knowledge. The students can actually see a skill or technique being used during a demonstration, and have the chance to ask questions or to give comments immediately. The teacher may provide the demonstration himself/herself, or the teacher may invite a local person with some expertise, such as a farmer or an extensionist to do so. Demonstrations can be useful in a number of ways:

- The teacher can use them to teach a complex task or skill in a series of clear, practical steps
- They can give the students more confidence in a difficult technique before they try it themselves
- Demonstrations provided by the teacher gives a chance to show and highlight otherwise dangerous practical activities in a safe environment

Box 3. Demonstrations.

Some points the teacher should remember about demonstrations

- The teacher should always be sure about how to carry out a demonstration before he or she shows the students; practise it first until you are sure how to do it.
- Demonstrations may require a lot of organization and preparation beforehand; the teacher should have everything prepared before he or she starts a lesson, otherwise the students will lose interest; also some demonstrations need costly materials, so the teacher should avoid wastage (but try to avoid using expensive materials when possible, as the students may not have access to these outside the institution).
- Involve the students as much as possible during a demonstration. Ask questions regularly, and check that they understand the procedure. The teacher can also involve students as helpers in demonstrations (as long as it is safe to do this); this increases interest for the whole group.
- The students should have a chance to practise the skill or technique after they have seen the demonstration. This will help them learn more effectively.
- Sometimes demonstrations do not work—this reflects the reality of agroforestry, and the teacher can always point this out if something goes wrong—but a good demonstration is worth a lot, so try to ensure success if at all possible! The teacher can also demonstrate how to do something in the wrong way, so that students can learn how 'not to do' something as well as how to do it correctly. Many people learn through their mistakes, and a teacher can sometimes make 'deliberate mistakes', in order to encourage learning and increase the opportunity for feedback and questions.

Practical activities

Agroforestry is essentially a practical area of study. It is important therefore that the teacher gives the students as much opportunity to practise skills and techniques as possible.

Box 4. Practical activities.

Practical activities can include

- Working on the institution's farm or garden, growing crops or rearing animals
- Making and using simple machines and equipment
- Doing experiments in the classroom, laboratory or field
- Doing management tasks like keeping records, accounts, etc.
- Working or meeting with local community members

As with demonstrations, practical activities should be well planned and well organized. The teacher will need to give support and advice to the students as they carry out the activity. If there are a large number of students in the class, they will almost certainly need to be divided into groups. Any practical activity should be carried out in relation to the classroom teaching. Very often, it is hard for students to relate practical activities to theory. In fact, the two should be linked together very closely. It is very important also to link the theory sessions to the practical experiences of the students.

Just as with theory lessons, the teacher should have clear aims and objectives for practical classes. The students should have a very clear idea about why they are doing the activity, and what they are supposed to achieve. It is also important that they record what they have done, in a practical notebook or diary. The teacher should observe the students closely, offer advice where necessary, and encourage them to ask questions. If they are having difficulties, the teacher should give them more chances to practise.

One difficulty with doing practical activities is that they are time-consuming. The teacher needs time to move to the practical area, to give out equipment, to do the activity and to bring all the equipment back again. For this reason, it is important not only to be organized but also to allocate a realistic time for practical activities. The teacher should try to make sure that some agroforestry teaching sessions have sufficient time for practical activities to be carried out. Also it is difficult to work outside during the hottest time of the day, so the teacher should try to arrange practical activities, which involve physical work for the early morning or late afternoon. Finally, the teacher should always leave enough time for cleaning up after practical activities, whether it is in the classroom, laboratory or field. The teacher should encourage the students to have a responsible attitude to materials, equipment and time.

Group and individual activities

Although the teacher will spend part of the lessons addressing the whole class, or demonstrating something to all students together, many activities can be carried out by the students in groups or individually.

Groups of students can, for example:

- Carry out experiments
- Prepare or use learning or demonstration materials (case studies, posters, charts, models, games, displays, etc.)
- Look after a garden plot or certain animals
- Carry out a project
- Prepare and perform a role-play

The teacher will need to pay careful attention to the way a group works together; he or she may find that one or two group members dominate the activity, so that some group members are left out of things, especially in planning and decision-making. Certain students may always be given the least pleasant task to do; other students may use the 'cover' of the group to avoid doing anything at all. Try to ensure that all group members share responsibilities and actions. The teacher may need to reorganize some groups if it appears that they are not functioning well. Watch out for the situation where the most able students always work together and those who have the most difficulty with their work always appear in their own group. This can be a good thing sometimes, since the 'able' group can be given additional tasks that go beyond the specific objectives for the lesson. The teacher will need to ensure

that the less able groups of students are given sufficient attention, however, so that they do manage to complete the activity to a satisfactory level.

Students can also undertake many activities individually, for example

- Reading books, papers, case studies, etc.
- Carrying out activities in the garden or farm
- Keeping a diary
- Carrying out an individual project
- Working through problems, calculations, etc.

When there are a large number of students in the class, the teacher may need to organize them into groups or ask them to work as individuals quite regularly; by doing this, the students can develop a deeper understanding of parts of the course. Encouraging students to work without the teacher and leading from the front is not an easy option for a teacher, however. The teacher will need to do a lot of preparation before the activity, for example preparing worksheets, reading materials and planning the practical activity. Also, during the activity the teacher will need to be available to all groups and individuals to guide them, and to ensure that all students are able to meet the objectives of the lesson.

Pro/'ecf *work*

Projects can be a very useful way of allowing the students to examine a topic or several topics together in greater depth. They can encourage students to increase their capacity to ask questions, make decisions and solve problems. Projects increase interest and motivation if the teacher allows the students to plan, carry out and write up their projects themselves, with help and guidance from the teacher.

One type of project could involve the students going into the local community and finding out the way in which local people carry out a certain activity, or what local farmers feel about a particular issue. This could involve a survey with interviews, or require other information- gathering methods such as mapping, transects or ranking exercises.

Box 5. Project work.

Some possible topics for this type of project are

- Identifying the main agroforestry systems in the area
- Finding out about the different roles of men, women and children in selecting tree species in agroforestry systems
- Discovering the views of local farmers about certain types of agroforestry crop or livestock
- Investigating the ways in which farmers market their produce
- Observing weed populations (for example, Imperata or other grasses) in different land use systems (for example, under plantations, compared with food cropping systems, and agroforestry systems). Students should perform further farmer interviews to find out whether farmers apply fertilizer and use herbicides.

There are many other possibilities. Encourage students to come up with their own ideas for the topic; ideas might come also from articles in the newspapers, items on the radio, or even from discussions at home. Another type of project could involve students identifying a problem with farmers, and in collaboration with them, designing a simple experiment that would aim to shed light on the issue.

When the students undertake projects, it is important that the teacher guide them during the early stages, as they may be new to the idea of project work. Each student should be clear about the problem to be addressed, what he or she is trying to find out, and how he or she intends to carry out the project. The teacher should ensure that the aim of each project is realistic; students have to do this in addition to all their other course work, and project work is time-consuming, so they should not be too ambitious. It is better if the teacher guides students towards projects that have a strong likelihood of a definite outcome; projects that end in no clear result can be discouraging after a lot of hard work has been put into them. Encourage students to write up their project work as they go along; the teacher should read and comment on it regularly to help them keep on track. The students may need extra help with writing up their results, discussing them and drawing conclusions. The project report should be clear, simple and sensible.

Field *visits*

The teacher will not be able to provide examples of every aspect of agroforestry practice within the institution. This guide stresses that agroforestry can involve a very wide range of technologies and means of practising these. The students will understand concepts much better if they have first-hand experience of them. So, the teacher should try to take the students to locations where they can see, touch and smell things for themselves.

The teacher may know a local farmer who has introduced intercropping, or another farmer who has established an agroforestry system. There may be a community fishpond close to a field, which has been row-planted with sunflowers or an orchard. There could be a site where soil-erosion is a particular problem, or a pit, which provides a demonstration of a soil profile. If it is possible, take the students out to visit such places; the institution may not have transport, so try to find useful locations within walking distance. The students may be able to suggest places themselves; they may know the area well.

It is important that a field visit serves an educational purpose, and is not just a 'sight-seeing' trip, although interest and enjoyment are important aspects of the field visit. Preparation is essential; the teacher should organize the visit well in advance and inform anyone who should know about it. Parents should be aware of the purpose of the trip.

Visits take time, and the teacher may not be able to fit one into the normal time allocated for the lesson; the teacher may need to arrange longer visits in non-teaching times (perhaps afternoons or weekends) but the teacher should discuss this with the students first—some of them may have other commitments.

To prepare for a visit, the teacher should always discuss the topic with the students in advance. The teacher could then ask them questions, which they should answer as a result of the visit, or give them a written sheet, which they should complete. During the visit, ask the students questions, and encourage them to ask questions as well. When they return to the institution, have a review of the visit as soon as possible to ensure that the learning objectives have been achieved.

On a safety note, the teacher has a great responsibility for the students while they are outside the institution, just as when they are inside; the teacher should ensure that they understand certain rules of behaviour whilst outside, and they should maintain good order and discipline at all times. This should keep the students safe. In addition, as they are representing their institution or community, the teacher should always try to develop good relations between the institution and the community.

Box 6. Field visits.

Tips in organizing field visits:

1. Field trips must have an objective for the students' learning experiences to be maximized
2. Do a suitability assessment to determine whether the field trip will fulfil the objectives
3. Plan for discussions during and after the field trip
4. Prepare the worksheets
5. Consider the distance of the location to visit and prepare an itinerary (time, location)
6. Inform the students' parents and get their written consent
7. Set up rules of behaviour to maintain order and discipline at all times
8. Inform the students what they should bring (for example, rubber boots, torch, etc.)
9. Make arrangements with the transportation facility to make the trip as comfortable as possible
10. Bring along a first-aid kit
11. Follow-up after field trip: Make a poster, a report or have a discussion in the classroom

Learning materials

A good teacher or trainer has a range of methods at his or her disposal, and knows when and where each can be effectively used. Methods are not enough in themselves however. Materials are also required. Sometimes these are described as media; in other words, they assist a teacher in the support of the learning process, and they are very closely linked to the learning outcomes, the

content and the methods of teaching and learning. As a basic rule, educational materials should be attractive, interesting, challenging, durable, economically viable to produce and well organized in terms of content to enhance the learning process. There are a number of steps to consider when developing learning materials:

- Establish the purpose of the materials
- Identify the target audience
- Decide the general types of material needed
- Establish the instructional objectives
- Decide on the content and methods
- Organize the presentation of the material
- Choose an attractive format and style
- Pre-test prototype materials and evaluate them
- Conduct an evaluation of the prepared material after a period of time, for revision if necessary

Audio-Visual (AV) aids

In the agroforestry curriculum that is developed, there may be some topics that cannot be taught by taking students on a field visit or by providing a demonstration. Sometimes, it is necessary to illustrate a topic using a visual aid. There are many kinds of visual aids; commercially produced visual aids will often be of very good quality but they may also be expensive. Some of the best visual aids can be prepared by teachers, students, or other local resource persons.

The *blackboard* or *chalkboard*

The blackboard or chalkboard is a piece of teaching equipment that is most commonly used by teachers and trainers, both for writing and for drawing (although overhead projectors are becoming more common nowadays). The text and drawings should be neatly put on the blackboard. One way of organizing the blackboard is to divide it into areas ('fields'), each of which may represent a page in students' notebooks. Some rules to follow for effective use of blackboards are:

- Move across the board gradually, not jumping about from one point to another
- Underline headings and important terms and statements
- Draw large, clearly labeled diagrams, which stand out from any notes
- Use a stick or string to draw straight lines or circles
- Use chalk in different ways to create different effects (fat or thin lines, shading, etc.)
- If there are certain shapes that need to be drawn regularly, make a template of thin wood or thick cardboard, which can be used to make neat diagrams

- When cleaning the blackboard, pull the duster across the board horizontally or down, vertically; sweeping the board in all directions creates a dirty board and a lot of dust.
- Blackboards should be cleaned before another teacher comes in to use it; if anything needs to be left for students for later use, this should be clearly marked (for example, 'please retain') and in the same way, respect the wishes of other teachers.

Overhead transparencies

Using overhead transparencies is one of the most popular methods of presentations at lectures and training courses. It is a simple and relatively inexpensive medium of presentation. However, there are certain points worth considering when preparing and presenting through overhead transparencies as listed in box 7, and examples of good and bad transparencies are shown in box 8.

Box 7. Hints for preparing and using overhead transparencies.

Do

- Choose sharp and contrasting colours in transparency sheet
- Ensure projection on screen is readable by the audience by adjusting lights in the room
- Ensure projector is properly focused
- Face the audience when presenting
- Switch off projector when not in use to avoid distraction
- Give enough time for the audience to read and digest the content of each sheet
- Keep a spare bulb ready at hand

Don't

- Use small and unreadable fonts
- Put much text on each sheet
- Block the view of the audience while using transparency
- Just read from the transparency sheet

Box 8. Examples of bad and good transparencies.

Example of a bad transparency

Description of alley cropping system: It is a system where rows of hedges are grown along contours at certain distance intervals. The recommended vertical distance between hedges is 1.5 m. The alleys between these hedgerows are allotted for growing agricultural crops. Contour lines are located using an A-frame.

Example of a good transparency

Alley cropping system

- Hedgerows along contours; inter-hedgerow distance: 1.5 m
- A-frame: for contour lines
- Alleys: for agricultural crops

Posters and flip charts

These materials combine photographs, figures, illustrations, caricatures, charts or tables with summarized text of key learning points. Posters can be put up on the walls of a classroom where students can refer to them every time they come to the class. Likewise, flip charts can be left by the teacher in the classroom for students to refer to as many times as they like.

Cassette tapes, video tapes and slides

- Cassette tapes: Audio recordings such as cassette tapes are useful, especially in areas where the radio is a common medium of mass communication. The advantage of audio recordings is that they enable learners to use their own imagination. Thus, through audio recordings it is easy to transmit feelings.
- Video tapes: These are useful for showing movements, functions and processes. Videos can be shown more effectively only to a small audience at a time if a television monitor is used. For large audience, a video projector should be used. A good video should be properly edited and have a good soundtrack.
- Slides: These are the most commonly used forms of photos in teaching because they can be projected onto a screen or wall. Slides can also be projected at the same time with audio recording for combined AV presentations. Slides are useful in certain cases, for example to show close-ups of very small objects or to highlight key steps in processes that are hazardous; or that occur too fast or too long to be viewed easily by students. Slides placed in slide trays are handy with flexibility to change the order, add or eliminate slides or replace those outdated slides with new ones.

Handouts

Handouts are useful materials given to students to supplement learning of topics delivered in the lectures. Transparencies used in overhead projections can also be photocopied and distributed as handouts to supplement the notes taken by students during the lecture. They can also be given before the lecture to enable the students to write their own notes on them.

Computer-based learning materials

Recent developments in computer technology enable the use of computer-based materials as teaching aids. These include multimedia presentations available on computer software, which learners can use interactively. This can be a very effective tool where available; but the technology is not yet available in average teaching situations, primarily because of high investment costs for the equipment.

Box 9. Other learning materials.

- Live objects (insects, plants, weeds, etc.)
- Models of real objects
- Board games
- Posters, brochures and extension materials

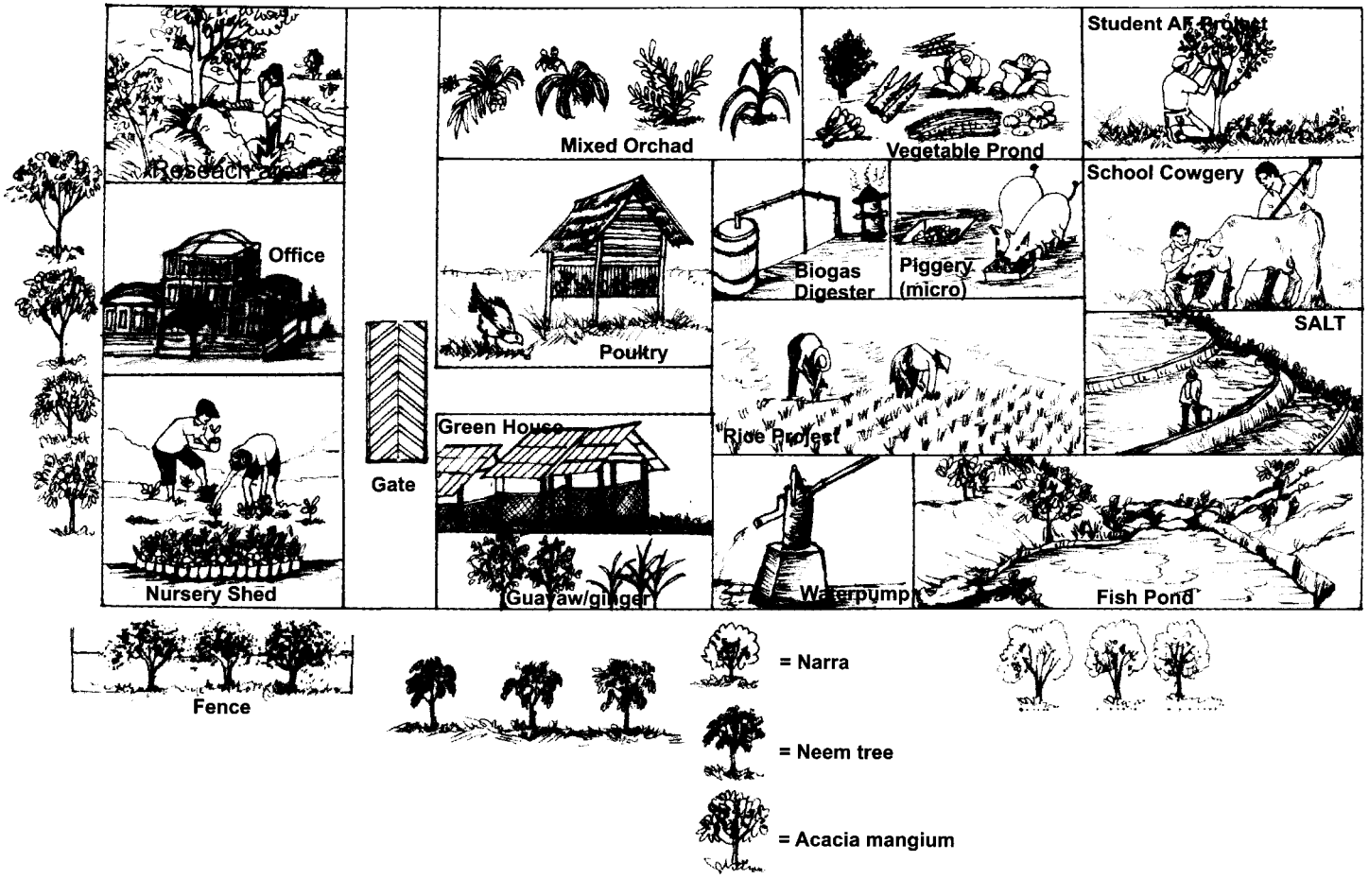
Practical exercises

The teaching-learning process can be significantly enhanced if the learners get hands-on experience in the field, of implementing newly learnt skills and knowledge. An area for this type of 'practicum' or 'learning laboratory' is deemed necessary, be it inside or outside the institution, to develop the competence of learners. A practical exercise enhances development of learners' confidence and capability of implementing agroforestry activities. A 'practicum laboratory' can be located either within the campus or outside it.

On-campus practical exercises

- Faculty-initiated and managed in-campus 'practicum laboratory': The concept is to develop and maintain a campus farm or an agroforestry demonstration plot within the college premises for the purpose of demonstrations during classroom and training courses. This can also serve as an area for research and extension while generating some income for the school. The concerned department or faculty remains responsible for maintenance of the farm. A tailor-made exercise may be developed to suit the requirements of a particular course within the campus grounds. As a part of the training course, the concerned trainer or teacher may propose the development of a specific 'practicum laboratory' and initiate it where budget and approval can be obtained.
- On-campus student agroforestry project: One approach is to provide an area inside the school premises for students to conduct their agroforestry development projects. Students could do all tasks from planning to implementation under the guidance of their assigned advisers. An agreement should be drawn up between students and the campus administration that upon completion, the projects and all their produce will go to the school.

Agroforestry demonstration farm



Off-campus practical exercises

- Off-campus student agroforestry projects: These may take the form of attachments with farmers or may even be on students' own fields, where these are available and practical. Suitable agroforestry systems can be planned in consultation with the farmers and the teachers. Agroforestry students may implement their plans upon approval from the supervisor. A team composed of relevant faculty members should conduct monthly monitoring and evaluation. The advantage of students carrying out their agroforestry project on their farms is the likelihood of continuation of agroforestry activities beyond student projects.
- In case of farmer training, participant farmers should be required to implement their agroforestry action plan (developed in consultation with their fellow participants and facilitators) in a real field context. Adequate guidance should be provided in the agroforestry layout plan and its implementation. An appropriate but simple and practical monitoring and evaluation system should be included in the plan and implemented accordingly.
- Externally supported off-campus practical exercises: An alternative way of developing a 'practicum laboratory' is to link with a government line agency (such as the Department of Environment and Natural Resources in the Philippines) or an interested non-government organization (NGO). The department will be responsible for finding an appropriate site for the project and assigning a project manager. The funding agency will provide the necessary financial assistance for establishment and maintenance of the project. The project manager will be responsible for site management and for producing reports required by the funding agency. A Memorandum of Agreement (MOA) may be signed between the department and the funding agency.
- Wherever possible, existing farms and projects of the government or of NGOs should be used, where learners can gain unique experience of real life management and implementation of agroforestry activities.

Sources of teaching-learning materials

A resourceful curriculum implementer should first take stock of what teaching and learning materials are available in the local setting. One may be surprised to discover a volume of untapped indigenous resources without resorting to sophisticated and expensive high-technology equipment. There is also likely to be a rich resource of experience, which can be drawn upon for development of case studies, projects, etc.

Examples of these include

- People
  - Students/learners—aside from their individual experiences, they can provide some samples of seeds, plants, animals, animal food, fertilizers, tools and the like. This links the home and the school and makes learning interesting.
  - Co-teachers/co-workers
  - Experts
  - Local farmers
  - Entrepreneurs
- Garden or school farm
- Business establishments
- Nearby farms with agroforestry activities

Safety concerns

As with other agricultural and forestry practices, safety precautions are important in agroforestry activities. Where work involves equipment, tools, machines, chemicals and animals, extra measures should be taken to minimize any risk to people. The need for safety measures in the field and while using agricultural implements must be clearly elaborated to learners. A cardinal rule in safety is 'a place for everything and everything in its place'. Hazards in laboratories must be clearly sign-posted and safety rules should be printed and posted in nearby but easily visible sites. Safe working practices and attitudes must be encouraged.

Environmental impact

Although intended for environmental benefits, new skills and agroforestry technology may have negative consequences if misused or inappropriately implemented. Where this is a possibility this aspect and necessary precautions that need to be taken should be explained to the learners. Also signs of damage to natural resources such as soil and water, and where this is happening, must be noticed, and acted upon, as soon as possible.

Evaluation of the curriculum

Introduction

Evaluation is an important part of any curriculum development process. It is inextricably linked with the other phases of the teaching-learning continuum. Traditionally, it is often dealt with at the end. Ideally, however, it should not be set apart and seen as a mere addition to instruction. Therefore, the modes of

and criteria for evaluation need to be formulated very early in the process of curriculum development. There are many questions that should be asked:

- What are the indicators of achievement?
- Have there been any changes in KSA (knowledge, skills and attitudes)?
- If so, to what extent?
- What factors contributed to the results?
- How can these be used to improve the curriculum and classroom delivery?

Basically, evaluation examines the process of the development of knowledge, skills, attitudes and behaviour, which underpins the concept of education and training (Rogers and Taylor 1998). There are, however, different components of evaluation. One of these is goal achievement, which focuses on whether the goals of the curriculum, the learning objectives, have been achieved, and what learning has taken place after a specified period of time. This creates a need for questions on how learning changes can be assessed. Objectives-oriented evaluation may only consider the short term, however, and be narrow in focus. For this reason, it is important also to consider impact assessment, which focuses on what differences the learning process has made to learners and their lives, their work and their relationships with others. It is also vital to involve different stakeholders throughout the evaluation process, just as in the case of other stages of the PCD cycle.

Evaluation defined

Curriculum evaluation, as its name suggests, examines 'the values' of the curriculum being used, including the content of the learning (what knowledge is worthwhile?) and the aims (what should this program of education and training be achieving?). It is more than assessment, which measures the performance of individual students (Rogers and Taylor 1998).

It may be seen as 'an attempt to obtain information on the effects of a training program, and to assess the value of the training in the light of that information'.

Additionally, Bloom (1971) defines evaluation as 'the systematic collection of evidence to determine whether, in fact, certain changes are taking place in the learner as well as to determine the amount or degree of change in individual students'. This implies two aspects of evaluation. The first aspect is *quantitative,* which involves gathering of data on student learning in terms of scores in a test. A second aspect is *qualitative,* which is the judgement on the acceptability or non-acceptability of the learning level, based on present standards.

Importance and uses of evaluation from the perspective of different stakeholders

The rationale for evaluation from the perspective of different stakeholders is as follows:

- Learners—provide feedback on whether they have mastered the lesson and whether they are ready to tackle the next activity. If not, there is a necessity for remedial measures.
- Teachers—provide judgement on whether teaching was effective or not. Were the objectives too many? Were the materials and methods appropriate and adequate? Where can improvement be initiated?
- Administrators—provide information on in-service training needs, promotion, retention and even separation of teachers and /or students from a school.
- Parents—give them ideas as to the type and intensity of intervention and assistance they can provide to their children.
- Curriculum task force—give a picture of how the learners are coping with the learning content of the curriculum, whether some aspects need to be revised in relation to the appropriateness for the level and readiness of the learner.
- Other stakeholders (e.g., community members, funding agencies, service providers)—different stakeholders will have different interests. If their interest is relevant then they should also play a role in the evaluation process.

Types of evaluation

The type of evaluation used may depend on different criteria, such as participation, sequence/time, or purpose.

There are two types of evaluation based on the criterion of participation:

- Internal evaluation—this is conducted by those directly involved in the curriculum like the learners, teachers, policy makers and evaluation experts.
- External evaluation—undertaken by people and organizations outside the training institution. This is important for those who have a higher degree of independence and objectivity, which make it possible to obtain an unbiased view on the effectiveness of the curriculum.

There are three types of evaluation based on sequence or time:

- Pre-course evaluation—this is done before the course itself has begun, by setting out not only the goals to be achieved but also the ways in which the achievements could be measured. It usually incorporates the results of the Training Needs Analysis (TNA).

- Process evaluation—this is a continuing process of assessing and reassessing the progress being made throughout the course, the direction in which the course is heading and the speed at which the goals are being achieved.
- Product evaluation—normally done at the end of the course or programme; to list the final achievement, to see whether the curriculum has achieved the goals set for it and what other outcomes have resulted. The aim of this form of evaluation is to see how valuable the course has been to the participants, to the institutions concerned and to the community in general (Rogers and Taylor 1998). Summative evaluation is sometimes called 'goal achievement' evaluation.

There are two types of evaluation based on purpose (Rogers and Taylor 1998).

- Summative evaluation is normally at the end of any course or programme. The purpose is to sum up the effects of the programme, to list final achievements, to see whether the curriculum has achieved the goals set for it and what other outcomes have resulted.
- Formative evaluation is an ongoing process of assessing and reassessing the progress being made throughout the course, the direction in which the course is heading, and the speed at which the goals are being achieved. Although formative evaluation will be undertaken throughout the course by teacher-trainers, often in association with students, provision should be made in the schedule of work for more systematic opportunities for review and assessment.

Characteristics of evaluation instruments and methods

An evaluation instrument should have the following characteristics:

- Validity—is a characteristic whereby the instrument measures what it is supposed to measure. In question form, "is the test appropriate or not?' If the objective is to demonstrate a skill (for example grafting) and the test is an essay on grafting, then it is 'invalid'. Face validity is when the instrument is acceptable, readable, and the vocabulary and terms used are appropriate to the clientele. Content validity deals with the adequacy of the items included in the instrument.
- Reliability—is the attribute of an instrument when it yields the same results when given to the same group at some other time or another comparable group under more or less similar conditions. It is synonymous to 'dependability' or consistency of the measuring 'device'.
- Objectivity—this refers to the degree of freedom an instrument has from factors that could unduly influence its outcomes.

There are different methods that can be used for evaluation:

- Self-assessment. Learners who are highly motivated to 'learn how to learn' may not need prodding to find out for themselves what behavioural changes occurred after exposure to a training program. With benchmark data in

their fingertips, they can compare their KSA before and after training. Being aware of this, they can make vital adjustments to their learning styles to cope with stated goals. Similarly, a teacher/facilitator can evaluate his or her methods and strategies for timely interventions if needed. Checklist which details of competencies to be acquired with criteria provided are useful tools for self-assessment.

- Peer evaluation. Colleagues who are users of the same curriculum evaluate their work all the time. They are in a position to reflect critically on what they are doing. Peer evaluation can be done on a regular basis to allow updating of possible alternatives.
- Learners may group together and help each other not only by providing guidance on how to cope with the content of the course but also by advising each other on performance and competency in different areas (Rogers and Taylor 1998).
- Stakeholder evaluation. All the above are stakeholders, but there may be others who can also become involved in the evaluation process. This may be quite time-consuming and complex. However, stakeholders should be encouraged to participate actively so that evaluation will be carried out effectively since this is the key to the successful development/revision of a curriculum.

Evaluation of student learning (goal achievement)

The 'heart' of evaluation is to assess how much and what kind of learning achievement have resulted in the curriculum. The methods of assessing student learning are many but some of the more often used methods used by experienced teachers are:

For assessing knowledge

- Asking questions
- Written assignment
- Objective tests
  - filling the blanks
  - multiple choice
  - matching type
  - true or false
  - others
- Essay type

For assessing skills

- Skills analysis—breaking down the skill into component parts
- Demonstration of skills
- Establishment of own farm

Aside from assessing practical skills, some skills to be assessed are skills of observation and recording, ability to interpret results of practical exercises, the ability to plan and implement the plans of a practical farming activity.

For assessing attitudes

- Participatory observation through role-play, simulations, drama or games or through projects done in a longer period of time
- Follow-through studies

Impact assessment

This measures the long-range effect of educational programmes after a learner has completed the formal instruction period and has left the institution. Enough time should be allowed to pass so that the longer-term rather than the short-term effects will emerge. Indicators should be formulated, ideally through a participatory process, describing how they can be measured and expressed. Examples of indicators of impact evaluation are:

- Number of graduates who passed the government licensure examination
- Employment of status of the graduates
- Dissemination and application of agroforestry technologies
- Increase of income
- « Improvement of the environment

Revising the existing curriculum

Once the feedback from the process and summative evaluation are at hand, there is a necessity for immediate action to make the curriculum responsive and relevant. Teachers can 'shift gears' if at midway there is something missing in instructional delivery. Adults have varied prior experiences and learning needs, thus a teacher/facilitator should be sensitive to such situations. From a broader perspective, there may be a need for all stakeholders to participate in the revision of the curriculum.

References

Bloom BS. (Ed.) 1956. Taxonomy of Educational Objectives: Cognitive Domain. David McKay, New York.

Chambers R. 1997. *Whose reality counts?* London: Intermediate Technology Publications.

Ewnetu Z, Temu A. 1999. Introducing agroforestry: A teaching guide for the technical level. Nairobi: ICRAF.

Hagmann J, with Chuma E, Murwira K, Connolly M. 1999. *Putting process into practice: Operationalising participatory extension.* ODI Agricultural Research and Extension Network, Network Paper No. 94, July 1999. London

International Tropical Timber Organization (ITTO). 1999. Guide for trainers. ITTO Project PD 13/95 Rev. 3(1). *Capacity building in training in planning and management of forestry industries in ITTO producer member countries.* Finland: ITTO.

Palma JC. 1992. *Curriculum development system.* Philippines: National Book Store Inc.

Rogers A, Taylor P. 1998. *A guide to participatory curriculum development in agricultural education.* Rome: Food and Agriculture Organization of the United Nations.

Rudebjer P, Del Castillo RA. 1999. How agroforestry is taught in Southeast Asia. A status and needs assessment in Indonesia, Lao PDR, Philippines, Thailand and Vietnam. Training and Education Report No 48. Bogor: ICRAF.

Skilbeck M. 1984. *School based curriculum development.* London: Harper and Row.

Taylor P. 1999. The agricultural science teachers' handbook. London. Cassell/VSO.

Taylor P. 2000. New perspectives, new curricula. A case study of participatory curriculum development in forestry education in Vietnam. Keynote paper for Workshop on Changing Learning and Education in Forestry. Sa Pa, Vietnam, April 16-19, 2000.

Voluntary Service Overseas/International Institute for Rural Reconstruction/Popular Education for People's Environment (VSO/IIRR/PEPE). 1998. *Creative training: a user's guide.* Philippines: VSO/ IIRR/PEPE.

Part II—Framework for agroforestry curricula

Chapter 3.

Developing and reviewing agroforestry curricula

A tool for curriculum planning

Part II of this guide aims at providing a tool for the development and review of agroforestry curricula. It outlines a general framework for the agroforestry content of an education programme or a training course.

In Southeast Asia, agroforestry is taught in a very wide range of institutional and ecological settings. Agroforestry may be included as a small course or topic in a certificate or diploma programme in forestry or agriculture; as in-service training course; or as a BSc or an MSc programme with substantial time allocated to agroforestry.

There are two main approaches to agroforestry:

- Agroforestry as an integrated part of natural resource management. This includes fields such as forestry, agriculture, animal husbandry, environmental sciences and landscape architecture, as well as economics and social sciences.
- Agroforestry as a 'specialized' field

This guide aims to support agroforestry curriculum development activities in both integrated programmes and specialized ones.

This general framework therefore needs to be adjusted to the local situation in which the training and education take place. This framework is not a curriculum but a flexible tool for the agroforestry curriculum development team.

Part I of this guide introduced the concept of participatory curriculum development, and discussed the different stages of the curriculum development cycle:

- Situation analysis
- Aims and objectives
- Planning the curriculum
- Implementation
- Evaluation

Building on the situation analysis and the aims set for the agroforestry education programme or training course, Part II of the guide deals with the planning of the curriculum. It is one of several tools that the curriculum developer may use. There are many others, such as existing curricula, participants' experiences, extension and research experiences, literature on agroforestry, etc.

The agroforestry curriculum framework, organized in five chapters, discusses the main elements that an agroforestry learner needs to be familiar with. Other subjects in the curriculum may cover some aspects of this framework. In some cases, existing courses in other faculties or departments of the institutions could be tapped. The framework provided is a guide only, which may be interpreted in many different ways.

Overview of the agroforestry curriculum framework

This chapter discusses the general competencies that people working in the field of agroforestry would benefit from. This includes the professional profile, as well as the general areas of knowledge, skills and attitudes. These traits apply both to people working in specialized agroforestry jobs and to the majority of people who would work with agroforestry as part of a broader, integrated perspective on natural resource management.

The actual curriculum framework is then presented in Chapters 4-7, which include the following topics:

Chapter 4. Concepts and principles of agroforestry

- Evolution of agroforestry
- Tree-crops-soil interactions

- Agroforestry in rural livelihood: subsistence production and cash income
- Environmental services in agroforestry systems
- Social and economic considerations of agroforestry
- Agroforestry in the landscape

Chapter 5. Agroforestry systems, practices and technologies

- Definitions of agroforestry systems practices and technologies
- Classification of agroforestry systems
- Tree domestication
- Local agroforestry systems and practices

Chapter 6. Institutions and policies related to agroforestry

- Institutional context
- Policies and programmes related to agroforestry

Chapter 7. Advancing agroforestry practices

- Participatory planning
- Technology generation, testing and dissemination
- Monitoring and evaluation

How each topic is presented

To facilitate the design of an effective teaching and learning process, each topic is presented in the following way:

- Main learning points
- Content
- Methods
- Materials
- Bibliography

Again, it should be emphasized that this framework is only one of several tools that decide the final outcome of the curriculum development process.

The professional profile

Agroforestry is about growing trees on farms to improve the livelihoods of the rural poor and to protect the natural resource base. About 1.2 billion people in developing countries—including a large number in Southeast Asia—depend on agroforestry products and services for their well-being.

Agroforestry, however, is a rather new profession, and while many jobs in the natural resource sector might require agroforestry competencies, specific agroforestry jobs are still relatively few in most countries in Southeast Asia. The natural career pathway that exists for forestry or agriculture is often

lacking in the field of agroforestry. While some graduates will undoubtedly find 'pure' agroforestry jobs, many or most will work in adjacent fields where an integrated perspective on natural resource management is useful.

Knowledge and skills

Agroforestry as farmers' practice and as a science embraces a wide range of disciplines. Agroforestry is part and parcel of a broader context of community-based natural resource management and rural development. It involves biophysical sciences such as agriculture and forestry as well as socioeconomics and local culture. The development of agroforestry also depends on institutions, in particular community-based institutions, and on policies. Agroforestry is a multidisciplinary and integrative field of learning.

Learners of agroforestry therefore need to be familiar with a range of disciplines related to natural resource management, and with the most common concepts and approaches in rural development. While the learner is not expected to become a specialist in the many fields that are related to agroforestry, he or she will become a very special type of generalist. The agroforestry student needs to be able to understand, integrate and communicate concepts and ideas about, and utilize knowledge and skills from, a range of disciplines adjacent to agroforestry (figure 6).

Some of these are often covered in other parts of the curriculum and only to a lesser extent are included in this framework. But curriculum developers should keep the multidisciplinary and integrative aspect of agroforestry learning in mind.

It is a challenge for the mostly sector-oriented education system to deal with the many dimensions of agroforestry learning. New and innovative approaches, institutional arrangements and partnerships are often needed. Team-teaching across faculty and department boundaries is often desirable.

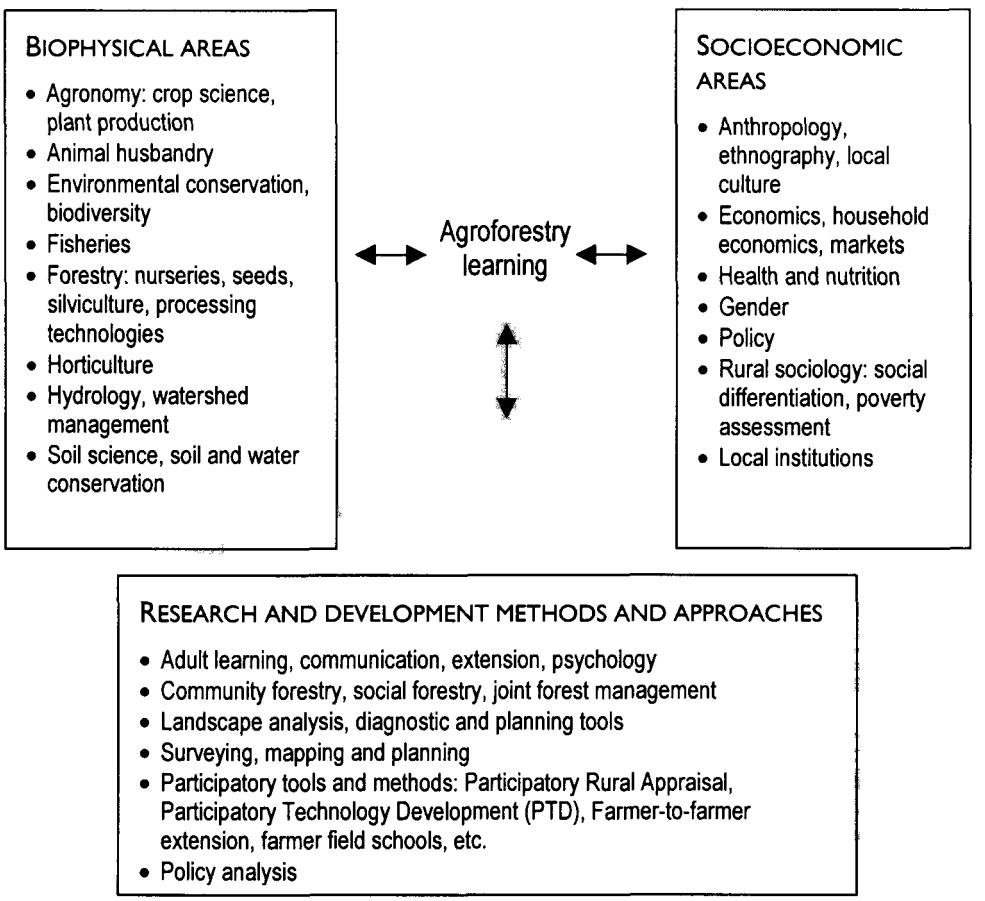


Figure 6. Agroforestry learning is linked to a range of disciplines.

Attitudes

The agroforestry education and training programme will provide the learner with certain perspectives on the professional profile required for agroforestry jobs. This applies both to 'specialized' agroforestry jobs, as well as jobs within the natural resource management, which require a broader integrated view on agroforestry.

It is important for curriculum developers and teachers to consider the attitudes that the educational programme intends to develop in the learner. While these attitudes may not be very different from those desired in other fields of natural resource management, they will help shape the professional profile of the student.

To effectively communicate in a diverse and complex agroforestry environment, a range of attitudes would be beneficial, including being:

- Integrative
- Systems-oriented
- Learner-centred
- Open-minded
- Culturally sensitive
- Empathic
- Resourceful
- Thoughtful/reflective
- Sharing/listening
- Ethical

The design of the curriculum, as well as the choice of teaching and learning methods should aim at developing these attitudes in the agroforestry student.

Chapter 4.

Concepts and principles of agroforestry

This chapter discusses the concepts and principles of agroforestry, thus providing an introduction to the learning of agroforestry. The main topics suggested for this introduction are

- Evolution of agroforestry
- Tree-crops-soil interactions
- Agroforestry and rural livelihood: subsistence production and cash income
- Environmental services in agroforestry systems
- Social and economic considerations of agroforestry
- Agroforestry in the landscape

Evolution of agroforestry

Agroforestry is a relatively new term, although it is as old as the farmers' practice. Agroforestry is rapidly evolving as a science and a practice. It is increasingly seen as an approach to improve the livelihood of the rural poor and to protect the natural resource base by growing trees on farms. Agroforestry science came into prominence only in the late 1970s. Subsequently, there has been progressive development in concept, philosophy, research, education and implementation approaches in agroforestry.

What is agroforestry? There have been many attempts to define agroforestry—both simple and complex definitions abound. There is an educational value in analysing a few of these definitions.

Definitions can be simple such as 'trees on farms' or complex, such as in the following examples:

> 'Agroforestry is a collective name for all land use systems and practices where woody perennial plants are deliberately grown on the same land management unit as agricultural crops and/or animals, either in a spatial mixture or in temporal sequence. There must be significant ecological and economic interactions between the woody and non-woody components' (Lundgren 1987).

or:

'Agroforestry is a dynamic, ecologically based, natural resource management system that, through the integration of trees in farm- and rangeland, diversifies and sustains smallholder production for increased social, economic and environmental benefits' (Leakey 1996).

Main learning points

- To explain why and how the term agroforestry, as a practice and a science, has evolved
- To explain the concept of agroforestry land use systems and on-farm trees
- To be familiar with definitions of agroforestry and understand the dynamic character of common agroforestry definitions, including biological components, time and space, and social dimensions
- To clarify differences and links between agroforestry, social forestry and other related land use terminology

Contents

- Land use changes and land degradation in the past, as well as present trends of land use change.
- Analysis of conflicts and complementarities between agriculture and forestry land use
- Evolution of agroforestry as an integrated approach to land use
- The main definitions of agroforestry, the biophysical components and their integration within the overall system, and the importance of ecological as well as economic functions
- Agroforestry as one of several types of tree-based rural development programmes, such as social forestry, community forestry, farm forestry, etc.

Methods

- Assignment to review literature related to the evolution of agroforestry
- Definitions can be illustrated by analysis of the term agroforestry, based on definitions and discussion on interrelationship of agroforestry components and a functional combination of those.
- Showing, through AV media, several agroforestry systems, where living and non-living components can be identified and analysed for their interrelationship and interdependency functions
- Study trips to have a more realistic view of agroforestry systems, followed by site discussions

Materials

- Pictures, slides, videotapes and aerial photos showing, for example, land use change at regional, national or even at local level, problems and various types of agroforestry systems
- Case study. Research results can be used to stimulate students in group discussions.

Bibliography

Huxley P. 1999. *Tropical Agroforestry.* Oxford: Blackwell Science Ltd.

ICRAF____. A series of lecture notes on integrated natural resource management based on experience in the alternatives to slash-and-burn project (forthcoming). ICRAF website: http://www.icraf.cgiar.org

Leakey R. 1996. Definition of agroforestry revisited. *Agroforestry Today* 8(1): 5-7. Nairobi: ICRAF.

Lundgren BO. 1987. Institutional aspects of agroforestry research and development. In: Steppler HA, Nair PKR, eds. Agroforestry: *a decade of development.* Nairobi: ICRAF. p 43-51.

Nair PKR, ed. 1993. *An introduction to agroforestry.* Dordrecht, Netherlands: Kluwer Academic Publishers in cooperation with ICRAF.

Tree-crops-soil interactions

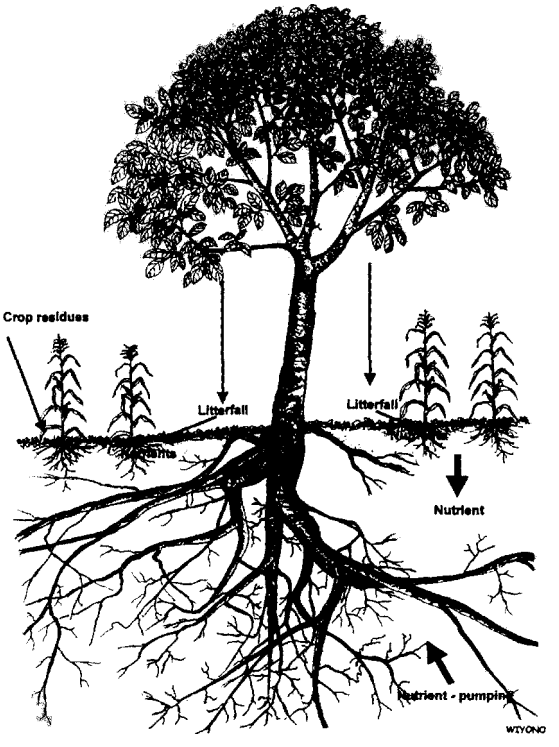
For a learner of agroforestry it is central to understand how trees, crops and animals interact. In simultaneous agroforestry systems, trees and crops can share above-ground and below-ground space. Trees and crops interact in many ways, leading to both positive (facilitation) and negative (interference) effects on the growth of both trees and crops. These processes, which are very complex, are related to light, water, nutrients and wind. These processes also affect the soil itself. There are also indirect interactions, for instance related to pests and diseases. This section discusses both the principles of these interactions, and the positive and negative effects that the interactions may have.

Cycling of soil organic matter, nutrients and water are processes that are central to understanding the interactions in agroforestry systems. With a thorough knowledge of these cycles, the tree-crops-soil interactions are then explored.

Main learning points

- To understand the biophysical processes involved in agroforestry systems
- To understand the role of agroforestry systems regarding nutrient and water cycling and in maintaining soil fertility

- To be familiar with the positive and negative tree-crops-soil interactions regarding light, water and nutrients
- To understand that there are trade-offs, and that farmers' decisions are complex and involve many non-biological factors



Contents

Components of agroforestry

- The main components in agroforestry systems: trees, crops, animals and soil
- Principles of the nutrient and water cycles and of light capture

Interactions

- Principles of component interactions in an agroforestry system, in relation to the nutrient and water cycles and light capture
- Positive interactions (below and above-ground):
  - Nutrient and water recycling
  - Role of tree root systems as: (I) a 'safety-net' for nutrients that have been leached down the soil profile, below the crop roots (and which would otherwise have been lost from the system), (2) a 'nutrient pump' for weathered minerals in deep soil layers.

  - Role of old tree-root channels in improving water infiltration and reducing soil erosion
  - Nitrogen supply by tree roots, due to root decay or by nitrogen fixation
  - Mycorrhizal associations to enhance phosphorus availability
  - Litter production, functions and quality of litter
  - Maintaining soil organic matter content
  - Mulching, soil moisture and soil biological activity
  - Shading
  - Microclimate improvement such as temperature, relative humidity, etc. (for example, coffee needs shading)
  - Maintaining carbon stock and above- and below-ground diversity
- Negative interactions (below and above-ground) that may be involved:
  - Above-ground competition for light
  - Below-ground competition for water and nutrients
  - Pests and diseases (for example, intercropped cassava may introduce white root disease to rubber)
  - Allelopathic effect
- Tree-crops-soil interactions and farmers' priorities

Methods

- Class presentation using AV (transparencies, posters with some photos and slide series, etc.), showing possible tree-crop interaction above-ground (by showing various canopy shapes) and below-ground (by showing various rooting patterns), and also showing how to test interactions in the field.
- Field observations: Tree-crop interaction
- Plot demonstration. Some simple exercises may be useful such as: exposing root distribution of different crops in one soil pit; showing several types of litter in the field and asking the students to describe its quality by hand-crushing, chewing, and chemical analysis in the laboratory (C, N, lignin and polyphenolics).
- Invite students to walk around to observe several tree canopy shapes and measure the light interception underneath
- Invite students to see and feel for themselves soil with a high and low organic material input
- Computer exercise, using a simulation model (WaNuLCAS = Water Nutrients and Light Capture of Agroforestry Systems) to improve students' knowledge on processes involved in agroforestry.
- Farmer interviews. Farmer experiences of benefits and problems of using agroforestry

Materials

- Pictures, posters, video, slide series (for example, ICRAF. 2000. Tree-crops-soil interactions. Slide series; ICRAF, 2000. Soil and water conservation. Slide series)
- Lecture notes, literature
- Experimental agroforestry plot
- Villages with different practices

Bibliography

Huxley P. 1999. *Tropical Agroforestry.* Oxford: Blackwell Science Ltd.

Ong CK, Huxley P. 1996. Tree crop-interactions—a *physiological approach.* CAB International, Wallingford UK. 386 pp.

ICRAF____. A series of lecture notes on integrated natural resource management, based on experience in the alternatives to slash-and-burn project (forthcoming). ICRAF website: http://www.icraf.cgiar.org

Sanchez P. 1995. Science in agroforestry. *Agroforestry Systems* 30:5-55.

Van Noordwijk M, Hairiah K. 2000. Tree-soil-crop interactions. Lecture note. Bogor: ICRAF.

Van Noordwijk M, Lusiana B. 2000. WaNuLCAS 2.0. Background on model of water, nutrient and light capture in agroforestry systems.

Van Noordwijk M, Verbist B. 2000. Soil and water conservation. Lecture note. Bogor: ICRAF.

Van Noordwijk M, Hairiah K, Lusiana B, Cadisch C. 1998. Tree-soil-crop interactions in sequential and simultaneous agroforestry systems. In: Bergstroom L, Kirchmann H, eds. Carbon and nutrient dynamics in natural and agricultural tropica/ ecosystems. CAB International, Wallingford UK. p 173-191.

Young A. 1989. *Agroforestry for soil conservation.* Wallingford, UK: CAB International.

Agroforestry and rural livelihood: subsistence production and cash income

This section discusses agroforestry from a rural livelihood perspective. Small-scale farmers are the key land managers in many watersheds. Therefore, understanding how rural households and local communities relate to, depend on and influence their environment is a key to a broad and deep understanding of agroforestry. The dynamics of how livelihood strategies change over time is also important.

Agroforestry can provide a range of products and services that contribute to both rural development and environmental conservation. This section deals with the products generated from agroforestry systems (environmental services

are covered in the next section). Products include food, wood and fibres, among others. Agroforestry is also a source of employment and income. Agroforestry systems can thereby contribute to food and nutritional security and increased rural income and employment opportunities.

In Southeast Asia, in particularly in the uplands, several ethnic minorities depend on the forests and forest margins for their livelihood. Understanding the ethnic diversity and its significance for land management and agroforestry development is therefore important.

Main learning points

- To understand the main livelihood strategies for rural households in key agroecosystems in the uplands, lowlands and coastal areas, and how these change over time
- To appreciate the role of agroforestry in providing food and nutritional security
- To appreciate the importance of wood fuel energy production
- To be aware of important wood and non-wood products from agroforestry systems, for subsistence consumption or for the market
- To be aware of opportunities for employment and cash income through agroforestry systems
- To be familiar with the ethnic diversity, particularly in the uplands and forest margins, and the importance of taking ethnic diversity into account in natural resource management

Contents

Livelihood strategies

- Analysis of the main livelihood strategies for rural households in key agroecosystems (note the difference between rich and poor households)
- Food and nutritional security
- Needs of communities to improve their livelihoods: education, health, water and sanitation, etc.
- Possible solutions to problems and constraints in the community

Ethnic minorities

- Importance and role of ethnic minorities in natural resource management

Subsistence production

- Overview of subsistence production from the farm, the forest and forest margins, with a particular emphasis on agroforestry products
- Production of food in agroforestry systems
- Wood and non-wood forest products from agroforestry systems
- Wood fuel energy from agroforestry trees and shrubs

Production for the market

- The main cash crops
- Production for the market from on-farm agroforestry systems, as well as wood and non-wood forest products from agroforestry systems on communal lands, forest margins and forests
- Employment opportunities and farmers' income in agroforestry systems

Trade-offs and farmers' choices

- Farmers' choices of agroforestry practices depend not only on the overall biophysical performance, but also on a range of socioeconomic factors. It is the farmers' perception of the overall system, rather than the total biophysical interactions that counts.
- Income versus risk: food security and farmers' income. Although yield of each component may decrease under mixed planting, agroforestry may reduce risk of harvest failure.
- Distribution of income over the year in an agroforestry system
- Trade-offs between the protection (of forests, soils and biodiversity) and production functions of the system
- Socioeconomic conditions under which agroforestry systems occur; land scarcity and population pressure; labour; off-farm employment opportunities
- Local cultural patterns and local knowledge

Methods

- Class presentation using AV (transparencies, posters with some photos and slide series, etc.)
- Group discussion: By giving some case studies, students can discuss within a group and write a report
- Field trips: Students should be asked to interview farmers, following guide questions prepared earlier in the class. Questions will deal with household needs (foods, fuel, fodder, etc.) and how they are to meet those needs (for example, food yield, amount generated from cash crops, etc.). Students' findings will be discussed in the class including their suggested recommendations.

Bibliography

Burch WR, Parker JK. 1992. *Social science applications in Asian agroforestry.* Winrock International through the Forestry/ Fuelwood Research and Development (F/FRED) Project. Published in India by Mohan Primlani. 187 pp.

Department of Environment and Natural Resources (DENR)/ Upland Development Program (UDP). 1994. *Participatory planning handbook for people-oriented forestry.* DENR/UDP. 112pp.

DENR/UDP. 1996. Basic community organizing for community-based forest management programs. 127 pp.

FORTROP 96. 1996. *Community ForestrylAgroforestiy. Volume* 7. Proceedings of the Tropical Forestry in the 21st Century (FORTROP 96) International Conference held at the Kasetsart University. Bangkok, Thailand. 193 pp.

Fujisaka S, Sajise P, Del Castillo R, eds. 1986. *Man, agriculture and the tropical forest change and development in the Philippine uplands.* Bangkok: Winrock International. 363 pp.

ICRAF____. A series of lecture notes on integrated natural resource management, based on experience in the alternatives to slash-and-burn project (forthcoming). ICRAF website: http://www.icraf.cgiar.org

IIRR/FAO/APAN. 1994. Resource management for upland areas in Southeast Asia: an information kit. Silang, Cavite, Philippines: IIRR. 207 pp.

International Institute for Rural Reconstruction (IIRR)/DENR/FF. 1992. *Agroforestry Technology Information Kit* 6 Volumes. Silang, Cavite, Philippines: IIRR.

RWEDP/FAO. 2000. *Wood Energy and Forestry Education.* Expert Consultation on the Integration of Wood Energy into the Training Curricula of Forestry Education held in Cha-am, Thailand, June 10-12, 1998. Field Document No. 56. Bangkok: FAO. 147 pp.

RWEDP/FAO. 2000. *Integration of Wood Energy in the Curricula for Forestry Training and Education.* National Experts Consultation held in India, December 15-18. 1998. RWEDP Report No. 50. Bangkok: FAO. 107 pp.

Sullivan GM, Huke SM, FoxJM, eds. 1992. *Financial and economic analyses of agroforestry systems.* Produced by the Nitrogen Fixing Tree Association and the Environment and Policy Institute with funding support from the USDA Forest Service and the USAID. 310 pp.

UNAC (Upland NGO Assistance Committee)/PBSP. 1998. Exploring commercially viable, community-based non-timber forest products (NTFP) enterprises: A mechanism for sustainable resource management. Proceedings of the 4th NTFP National Conference held on 2-4 September 1998 in Antipolo, Rizal, Philippines under UNAC sponsorship and the Philippine Business for Social Progress (PBSP). 146 pp.

University of the Philippines Los Bancs (UPLB) Agroforestry Program (now Institute of Agroforestry). 1994. *Agroforestry project planning and management a training manual.* College, Laguna, Philippines: UPLB and Kapwa Upliftment Foundation. 257 pp.

UPLB/DENR. 1995. *Community planning by distance learning approach.* Quezon City, Philippines: Department of Environment and Natural Resources. 46 pp.

UPLB/DENR. 1995. *Farm planning by distance learning approach.* Quezon City, Philippines: Department of Environment and Natural Resources. 96 pp.

Environmental services in agroforestry systems

Land use is rapidly changing in the tropics and many countries experience an environmental degradation due to decline in forest cover, loss or degradation of arable land and a subsequent loss of ecosystem functions. At the local level, unsustainable land use practices cause soil erosion and declining soil fertility and changes in the water cycle. At the regional and global level, biodiversity and climate change are affected.

Agroforestry practices can help mitigate or reverse these trends. By incorporating trees in more intensively managed agroecosystems, a number of environmental services are enhanced at farm level as well as globally. Environmental services include improved soil fertility, reduced pressure on remaining forests, biodiversity conservation ex-situ, carbon storage, as well as restored 'forest functions'.

Main learning points

- To understand the causes and effects of land use change at farm level (soil, nutrients, water) and landscape level (carbon stock and emission of greenhouse gases, biodiversity, water quantity and quality).
- To be familiar with environmental conservation and international conventions, in particular the Convention on Climate Change, and the Convention on Biological Diversity, and how they relate to watershed management and agroforestry systems.
- To recognize the need for soil and water conservation, biodiversity conservation and reduced emissions of green house gases, and appreciate the role that agroforestry development—trees on farms—can play in this process.

Contents

Land use change

- The underlying causes for land use change in relation to farmers' and other stakeholders' activities
- Slash-and-burn as a technique: benefits and problems
- Negative and positive trends, as well as opportunities for improvement towards sustainable land use

Plot/farm level

- Land use change at plot level and how it relates to soil erosion, soil fertility, nutrient availability and soil physical conditions; water availability and flow; weeds, pests and diseases, etc.

Global impact

- Climate change, carbon stock; climate change and greenhouse gas emissions
- Biodiversity conservation
- International conventions on climate change and on biodiversity

Role of agroforestry

- The role of agroforestry practices—trees on farms in a watershed— to enhance the environmental services and functions

Method

- Class presentation, using AV (transparencies, posters with some photos and slide series, etc.) showing the impact of land use change on soil fertility conditions, water quality, etc.
- Field trip can be organized to visit several villages in one topographic sequence, to get ideas of different cropping systems and their impact on soil erosion and water quality. Measurements of carbon stock and greenhouse gas emissions can be done directly in the field.
- Case study. Provide a series of environmental assessment data and ask students to discuss it within the group, followed by a presentation.
- Computer exercise. To improve the students' knowledge on the impact of land use change on water distribution at the landscape level, a model simulation such as PC Raster or others could be used.
- In discussing farmers' land use, some questions could be raised: What do farmers do and why do they do so? Does it matter? Could they do it differently? Why don't they do it differently? What are the indicators of the environmental impacts? How can they be measured?

Materials

- Land use maps from different times
- AV teaching materials
- Handouts, posters and literature related to the topic
- Report of survey on biodiversity, ethnic diversity, and buffer zone management

Bibliography

Huxley P. 1999. *Tropical Agroforestry.* Oxford: Blackwel Science Ltd.

Murdiarso D, Van Noordwijk M, Suyamto DA, eds. 1998. *Modelling global change impacts on* the *soil environment.* ICRAF-SEA Report No 6/GCTE Working Document No. 28. Bogor: BIOTROP-GCTE/ICRAF-SEA.

ICRAF_____. A series of lecture notes on integrated natural resource management, based on experience in the alternatives to slash-and-burn project (forthcoming). ICRAF website: http://www.icraf.cgiar.org

Sanchez PA, Logan TL. 1992. Myths and science about the chemistry and fertility of soils in the tropics. In: Lal R, Sanches PA, eds. Myths and science of soils in the tropics. SSSA Special Publication 29:335-46. Madison, Wisconsin: Soil Science Society of America.

Tomich TP, Van Noordwijk M, Budidarsono S, Gillison A, Kusumanto T, Murdiyarso D, Stolle F, Fagi AM, eds. 1998. *Alternatives to slash and burn. Summary Report Phase II.* ASB-Indonesia Report No. 8. Bogor: ASB-lndonesia and ICRAF SE Asia.

Van Noordwijk M, Tomich TP, Garrity DP, Fagi AM. 1997. *Alternatives to slash-and-burn research in Indonesia.* ASB-lndonesia Report no. 6. Bogor: Agency for Agricultural Research and Development.

Van Noordwijk M, Tomich TP, Winahyu R, Murdiyarso D, Partoharjono S, Fagi AM, eds. 1995. *Alternatives to slash and burn in Indonesia. Summary Report Phase I.* ASB-Indonesia Report No. 4. Bogor: ASB-Indonesia and ICRAF SE Asia.

Van Noordwijk M, Verbist B. 2000. Soil and water conservation. Lecture notes and slide series. ICRAF SE Asia, Bogor

Young A. 1989. Agroforestry for soil conservation. Wallingford, UK: CAB International.

Social and economic considerations of agroforestry

Social and economic aspects of agroforestry are critical factors in characterizing agroforestry systems. Social considerations are important because agroforestry emphasizes the relationship of trees and people. Economic considerations should be taken into account, since they will determine the ultimate value and feasibility of agroforestry for the land user. The social and economic considerations are important for traditional as well as 'new' agroforestry systems. These aspects are closely linked to increasing land pressure, changing social perceptions and modern land use options. All this underscores the need for new economic evaluations in many existing systems.

This topic will be discussed in further detail throughout chapter 7. Therefore, this chapter will only briefly discuss the principles and concepts of social and economic considerations of agroforestry.

Main learning points

- To recognize that the rural poor are primary beneficiaries of agroforestry
- To appreciate the importance of social and economic considerations in agroforestry
- To be familiar with the important factors affecting the adoption and impact of agroforestry
- To be familiar with the basic economic concepts as they relate to agroforestry systems and the feasibility of agricultural enterprises
- To be aware of how social and economic changes affect the management of natural resources

Contents

Social considerations of agroforestry

- Agroforestry as it relates to social sciences
- Important sociocultural factors in agroforestry (land tenure, labour, marketability of products, gender issues, and other social factors)
- Farmers' perception of tree planting; local/indigenous knowledge

- Government policies and agroforestry implementation
- Social acceptability of agroforestry interventions

Economic considerations of agroforestry

- Influence of economic factors on land use choices among rural households and communities
- General principles of economic analysis
- Financial and economic analyses of agroforestry systems and enterprises
- Project analysis (including evaluation: discounting and the discount rate, evaluation criteria, farm budgets, quantification and valuation, and risk evaluation)

Methods

- Role-play
- Group discussion
- Field visits

Materials

- Manual
- Handouts
- Visual materials

Bibliography

Hoekstra D. No Date. Economic evaluation of agroforestry. Lecture Notes. Introductory training course: Agroforestry research for integrated land use. Nairobi: ICRAF.

ICRAF_____. A series of lecture notes on integrated natural resource management, based on experience in the alternatives to slash-and-burn project (forthcoming). ICRAF website: http://www.icraf.cgiar.org

Nair PKR, ed. 1989. An *introduction to agroforestry*. Dordrecht, Netherlands: Kluwer Academic Publishers in cooperation with ICRAF.

Place C. No date. An introduction to sociological evaluation: Lecture Notes. Introductory training course: Agroforestry research for integrated land use Nairobi: ICRAF.

Zeleke E, Temu AB, eds. 1999. *Introducing agroforestry: a teaching guide for the technical level.* Training and Education Report No. 45. Nairobi: ICRAF.

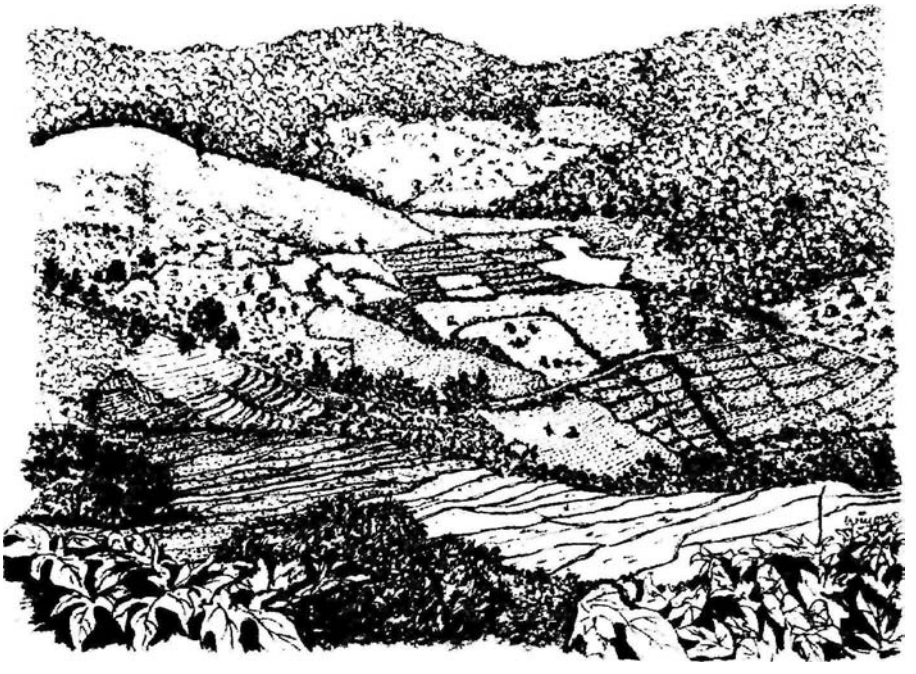
Agroforestry in the landscape

A watershed or catchment area is the most suitable level for analysis of natural resource management. A succession of ecosystems, or agroecosystems, from the mountains to the sea level interact and affect each other through the

movement of water and soils and through the human activities in the respective agroecosystems.

To understand the role of agroforestry at the landscape level, it is therefore a good starting point to discuss the watershed. In most cases, a typical pattern of land uses (agroecosystems) can be identified within the watershed. These land uses are not static, but change with time depending on factors like land productivity, population, technology development, policy and institutions.

The land use practices in a watershed have both on-site and off-site effects. The individual farming household appreciates the on-site effects—they directly affect the farming enterprise. The off-farm effects (externalities) affect a much larger group of stakeholders. To control or regulate these effects, the society may institute formal and non-formal regulations and organizations through policy and institutions. Understanding the on-farm and off-farm effects of land use, as well as upstream and downstream interactions is, therefore, important.



Main learning points

- To be familiar with the main characteristics of the main upland, lowland and coastal/marine ecosystems
- To be familiar with past and present land use changes in the major ecosystems in a watershed

- To understand the underlying causes behind these changes in relation to population, agricultural and forestry practices, market influences, policy and institutions, etc.
- To understand the on-farm and off-farm effects of current land use practices
- To understand the upstream-downstream interaction among the major ecosystems, with emphasis on land use and the role of trees in the landscape
- To appreciate how agroforestry innovations can affect interactions in a watershed

Contents

Definitions

- Definitions of main terms including ecosystem, uplands, lowlands, coastal/marine and watershed

Characterization of ecosystems and land use

- Description of main natural and man-made ecosystems/agroecosystems in a watershed
- Biophysical characteristics: soils, vegetation, topography, climate
- Land use: farming systems, agroforestry practices; other land uses
- Socioeconomic information: population, including indigenous people; migration; gender and cultural aspects; on-farm and off-farm economic activities; marketing and market access; infrastructure; land and tree tenure.

Relations between household level and watershed level

- Population growth and migration patterns
- Relationships between land use practices by rural household and effects on the watershed. What do farmers do and why do they do so? How does this affect the watershed?
- Intensification of agriculture and how this affects the use of on-farm trees
- Sustainability of land use and natural resource management

Changes, trends and interactions between ecosystems

- Past and present changes and trends in land use in each ecosystem, and interactions between key ecosystems
- Land use change: deforestation, alternatives to slash-and-burn agriculture, potentials of agroforestry systems for maintaining or rehabilitating watershed functions
- Analysis of the underlying causes behind the changes
- On-farm practices and off-farm effects
- Interrelationship—upstream and downstream effects—among the major ecosystems. Both biophysical effects, in particular, regarding soil and water, and socioeconomic interactions should be dealt with.

Agroforestry in the watershed

- The role of agroforestry at the watershed level—the landscape mosaic
- Traditional agroforestry practices, and more recent agroforestry innovations in the watershed
- Watershed classification in relation to land suitability and capability

Materials

- Maps—watershed topographic maps and geographic maps of downstream currents
- Posters—illustrating environmental impact of disturbed/degraded forest versus untouched forest
- Case study reports on the impact of certain watershed management projects
- Documents on the Convention on Climate Change, the Convention on Biological Diversity and the Earth Summit

Bibliography

Huxley P. 1999. *Tropical agroforestry.* Oxford: Blackwell Science Ltd.

ICRAF____. A series of lecture notes on integrated natural resource management, based on experience in the alternatives to slash-and-burn project (forthcoming). ICRAF website: http://www.icraf.cgiar.org

Van Noordwijk M, Verbist B. 2000. Soil and water conservation. Lecture notes and slide series. Bogor: ICRAF.

Young A. 1997. *Agroforestry for soil management.* 2nd ed. Wallingford, UK: CAB International and ICRAF.

Chapter 5.

Agroforestry systems, practices and technologies

This chapter discusses the concept of agroforestry systems and their classification. It further deals with the domestication of trees that are included in these systems. It aims at developing skills to identify and characterize various systems with particular emphasis on local systems and practices.

The chapter covers the following topics:

- Definitions of agroforestry systems, practices and technologies
- Classification of agroforestry systems
- Tree domestication for agroforestry
- Identification and characterization, and assessment of local agroforestry systems/practices

Definitions of agroforestry systems, practices and technologies

The terms *systems, practices* and *technologies* are frequently encountered in the agroforestry literature. Even though definitions of these terms have been proposed in the literature, the terms are used very loosely and often as synonyms. However, exploring the meanings and differences of these terms will help reduce the confusion that currently exists.

Main learning point

- To understand and be able to clarify and explain the terms systems, practices and technologies and their differences in the context of agroforestry

Contents

Definitions of agroforestry systems, practices and technologies

A system is an orderly combination of components (or elements, parts or subsystems) that interact with each other and with the environment to perform a functional role. For instance, an ecological system (or ecosystem) consists of organisms (flora and fauna) that interact with each other and with their

immediate environment (soil, climatic factors) and result in cycling of nutrients and flow of energy. People may manipulate the system components in order to maximize the desired outputs from the system.

The terms agroforestry *systems, practices* and *technologies* are frequently encountered. In fact, these terms are often used interchangeably. Although there is no definite definition of these terms, some characteristics are suggested:

- Agroforestry system: A land use system, which incorporates trees and crops and/or animals and with ecological and economic interactions among these components. Normally, it implies this is a pattern of land use occurring within a geographical area. Examples include alley cropping and home garden systems.
- Agroforestry practice: Any activity that farmers carry out within an agroforestry system such as hedgerow planting of *Leucaena,* or planting of rubber seedlings in a multistrata agroforestry system.
- Agroforestry technology: Refers to an improvement in the existing system, through generation and transfer of knowledge and skills or material inputs. This may be either scientist-developed or farmer-developed. Examples include high-yielding variety of maize or a multipurpose tree species, recommendation for fertilizer application rate, and improved rubber-tapping technique.

Methods

Slides, posters and video clippings of various agroforestry systems along with examples of some forms under each system. Students may be asked to specify more forms they observe in the teaching materials used. Moreover, students can be asked which of the slides, posters or video clippings or components in them are systems, practices and technologies.

Bibliography

Mac Dicken KG, Vergara NT, eds. 1990. *Agroforestry: classification and management* New York: John Wiley.

Nair PKR. 1990. Classification of agroforestry systems. In: MacDicken and Vergara, eds. *Agroforestry: classification and management.* New York: John Wiley.

Nair PKR, ed. 1993. *An introduction to agroforestry.* Dordrecht, Netherlands: Kluwer Academic Publishers in cooperation with ICRAF.

Classification of agroforestry systems

A large number agroforestry systems and practices exist around the world and many different classifications have been proposed to identify and characterize them. There is no 'best' method of classification of agroforestry systems, although some may be more useful than others. The purpose of a general classification is to identify various agroforestry systems and characterize them. Students of agroforestry must acquire the knowledge and skills of identifying these agroforestry systems and practices as well as analysing them to understand their strengths, weaknesses and opportunities.

Main learning points

- To understand basic criteria for classifying agroforestry systems based on the structure (components involved), predominant use of tree components, temporal and spatial arrangement of trees and crops.
- To be familiar with the common classification of main agroforestry practices

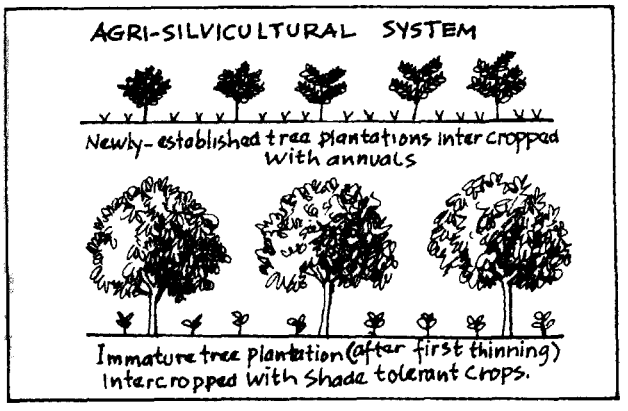
Contents

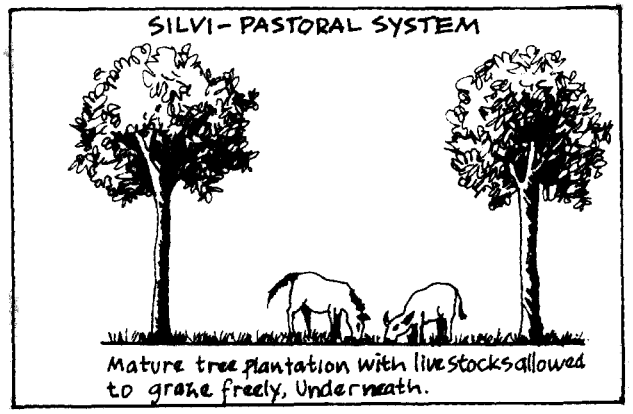
Classification of agroforestry systems

As an example, the most commonly used agroforestry classification approach, which is based on the structure and composition of the agroforestry systems, is given in table 2. It should be noted that this is not an exhaustive list and many more combinations and permutations may be possible. Moreover, additional classification systems based on functions, ecological zonation, land altitude, economics, and socioculture are also available. Students may be encouraged to develop their own way of classifying the agroforestry systems that they are aware of.

Table 2. Structural classification and examples of key agroforestry systems.

Systems	Key components	Examples/Forms
Agrisilviculture	Trees with crops	Shifting cultivation Alley cropping with Leucaena Taungya system in Burma Coffee and pepper system in South Sumatra Sloping Agricultural Land Technology (SALT-1 in the Philippines) Jungle rubber agroforestry system in Jambi, Indonesia Complex damar agroforestry system in South Sumatra Homegardens in Java and Sri Lanka
Silvipasture	Trees with pastures and livestock	Grazing livestock in tree plantations Simple agrolivestock technology (SALT-2 in the Philippines)
Agrisilvipasture	Trees with crops and livestock	Raising chickens in home gardens
Special component systems	Trees with insects Trees with fish	Entomo-forestry Aqua-forestry





Methods

Commonly used training materials such as slides, posters and video clippings of various agroforestry systems may be used. Students may be asked to classify a range of agroforestry systems using several criteria. Identification and analysis of the key components along with their comments on the overall functioning and production aspects may be discussed. Field visits in the vicinity will be extremely revealing, especially if students prepare reports on their visits followed by group discussions in the classroom.

Bibliography

Avery MD, Cannell MGR, Ong C, eds. 1991. *Biophysical research for Asian agroforestry.* Winrock International and South Asia Books. USA. 292 pp.

Bentley WR, Khosla PK, Seckler K, eds. 1993. *Agroforestry in South Asia: Problems and applied research perspectives.* New Delhi: Winrock International and Oxford & IBH Publishing Co. Pvt. Ltd., 367 pp.

Dalmacio RV. 2000. Agroforestry: Concepts, principles and practices. Pictorial lecture notes in 39 Power Point slides. Los Banos University of Philippines Los Banos.

De Foresta H, et al. 2000. Complex agroforests. Lecture notes and slide series. Bogor, Indonesia: ICRAF.

Hoekstra DA, Kuguru FM, eds. 1983. *Agroforestry systems for small-scale farmers.* Proceedings of the ICRAF/BAT Workshop held in Nairobi in September 1992. 283 pp.

Mac Dicken KG, Vergara NT, eds. 1990. Agroforestry.' *classification and management* New York: John Wiley.

Mellink, WYS Rao, MacDicken KG, eds. 1991. *Agroforestry in Asia and Pacific.* Bangkok: FAO Regional Office for Asia and the Pacific and Winrock International. 304 pp.

Nair PKR, ed. 1993. *An introduction to agroforestry.* Dordrecht, Netherlands: Kluwer Academic Publishers in cooperation with ICRAF.

Nair PKR. 1990. Classification of agroforestry systems. In: MacDicken KG and Vergara N, eds. 1990. *Agroforestry: classification and management.* New York: John Wiley.

Sinclair FL. 1999. A general classification of agroforestry practice. In: *Agroforestry Systems* 46:161-180. 1999. Dordrecht: Kluwer Academic Publishers.

UPLB. 1994. Agroforestry production and postproduction systems (APPS)—A training manual. Los Banos: UPLB Institute of Agroforestry.

Zhaohua Z, Mantang C, Shiji W, Youxu J, eds. 1991. Agroforestry systems in China. Chinese Academy of Forestry and the International Development Research Centre. 216 pp.

Tree domestication

Smallholder farmers harvest 'non-wood' forest products or 'non-timber' forest products (that is, food, fuel, fodder, medicines, building materials, resins, dyes, flavouring) from a large number of tree species. The range of tree species in agroforestry systems is much larger than the relatively limited number used for

industrial purposes. It is this huge genetic variation that provides the basis for selection and improvement of many indigenous species used in agroforestry systems. These tree species are sometimes called multipurpose trees, 'Cinderella' trees or agroforestry trees.

Through tree domestication—human-influenced change of the genetics of a plant—the value of and benefits from these trees can be adapted and increased. The pressure on the remaining forests might be reduced while at the same time ensuring the availability of these non-wood products to smallholder farmers. Tree domestication also means an ex-situ preservation of germplasm.

In applied terms, tree domestication is the naturalization of a species to improve its cultivation and use for mankind. Tree domestication can expand tree management options for smallholder farmers and help them become successful tree cultivators.

Main learning points

- To understand the concept of tree domestication
- To appreciate the importance of tree domestication to the smallholder farmers in particular and to the environment, including the preservation of germplasm
- To be familiar with the different activities involved in the tree domestication process or continuum
- To be aware of the different requirements for and constraints to successful tree growing by smallholder farmers

Content

Tree domestication principles

- Principles for tree domestication and genetic improvement
- Genetic variation, selection and breeding
- The status and importance of agroforestry tree domestication for germplasm preservation, and for farmers' benefits
- Agroforestry tree species already domesticated, or with a potential for domestication

The free domestication process

The steps involved in the tree domestication process include:

- Exploration and collection of natural populations
- Evaluation and selection of suitable species and provenances
- Developing propagation techniques
- Multiplication and dissemination of germplasm
- Developing management techniques

- Utilization and tree-product marketing
- Dissemination of relevant technical information

Smallholders and tree domestication

Factors influencing success of farmers' tree cultivation are, for example:

- Secure land and tree tenure
- Market access
- Germplasm access
- Tree cultivation support programmes (loans, government extension activities)
- Technical know-how, including propagation and management skills

Methods

- Lectures and case studies
- Assignments/group discussions on tree growing culture among small-scale farmers, that is, the reasons for growing or not growing trees on their farm
- Student assignments to list already domesticated and the potential tree species for domestication
- Student field trips to explore the potential of domesticating selected tree species

Bibliography

Leakey RRB, Newton AC, eds. 1994. *Tropical trees: the potential for domestication and the re-building for forest resources.* Proceedings of a conference, held 23- 28 August 1992, Edinburgh, UK. London: HMSO.

Leakey RRB, Tomich TP. 1999. Domestication of tropical trees: from biology to economics and policy. In: Buck LE, Lassoie JP, Fernandes ECM, eds. 1999. *Agroforestry in sustainable agricultural systems.* New York, NY: CRC Press/Lewis Publishers, p 319-338.

Roshetko JM, Verbist B. 2000. Tree domestication. Lecture notes. Bogor: ICRAF.

RoshetkoJM, Evans DO, eds. 1999. *Domestication of agroforestry trees in Southeast Asia.* Proceedings of a regional workshop held November 4-7, 1997, in Yogyakarta, Indonesia. Forest, Farm, and Community Tree Research Reports Special Issue: Taiwan Research Institute and Council of Agriculture, Taiwan, Republic of China, Winrock International, Morrilton, Arkansas, USA, International Centre for Research in Agroforestry, Nairobi, Kenya.

Wood PJ, Burley J. 1991. A tree for all reasons: the introduction and evaluation of multipurpose trees for agroforestry. Nairobi: ICRAF.

Local agroforestry systems and practices

Based on the general classification of different agroforestry systems, this section provides students with the necessary ability to identify and understand the common local agroforestry systems and practices. It covers both the biophysical and production components of those local agroforestry systems. This topic also deals with an assessment of these agroforestry systems from the point of view of productivity, sustainability and adoptability (criteria to be taken not singly but collectively).

Main learning points

- To be familiar with commonly practised agroforestry systems in the local setting—district, region or country
- To evaluate strengths, limitations and opportunities of common local agroforestry systems. Aspects for evaluation may include various tree-crops-animal components, seeds, planting materials, labour and financial issues.
- To understand the concepts of productivity, sustainability and adoptability of agroforestry systems
- To be familiar with productivity, sustainability and adoptability criteria and indicators in assessing agroforestry systems

Contents

Identifying and describing local agroforestry practices

- Methods and skills required to identify and describe local agroforestry systems and practices adequately
- The strengths, limitations and opportunities for improvements of local agroforestry systems. Some of the key aspects for consideration in this appraisal are provided in table 3.

Table 3. Suggested content of the section for analysis of local agroforestry practices.

Component	Aspects
Land and soil	Soil and land type
	Field preparation
	Soil fertility management
	Soil and water conservation
Trees	Nursery techniques
	Planting techniques
	IPM (Integrated Pest Management)
	Management (thinning, pruning)
	Harvesting methods
Crops	Crop types
	Preparation of planting materials
	Planting techniques
	Cropping schedules
	Crop management
	Irrigation/water management
	IPM (weeding, diseases + pest control)
	Harvesting methods
Livestock	Livestock type and breeds
	Hatching and brooding (for poultry)
	Vaccination
	Fodder and feed preparation
	Feeding
	Management (for each type of livestock)
Post-harvest technology	Handling, storing, processing and packaging of each agroforestry product

Assessment of agroforestry systems

The ability to properly assess agroforestry systems is an important skill. Ways to evaluate the 'quality' of an agroforestry system must be mastered. The general criteria and indicators used in assessment include productivity, sustainability and adoptability of any system or practice. The importance of socioeconomic factors for adoption of agroforestry innovations needs to be emphasized.

- Productivity aspects of agroforestry: tangible and non-tangible outputs and benefits from an agroforestry system
- Methods for quantifying productivity
- The concept of sustainability of agroforestry systems in the context of integrated natural resource management
- Adoptability considerations: social and cultural acceptance; importance of local knowledge, practice and capacity; as well as equity and gender issues

Method

- Lectures, discussions and field trips can be used to introduce the topic
- Students' experiences can be especially interesting to share among the learners. This should lead students to understand and document different agroforestry systems and practices encountered locally. Appropriate field visits must be planned either for the whole class at one time or in smaller groups if the class is big.
- Every student could be asked to produce a list of local agroforestry systems, the outline of which should be first discussed with the teacher. Student reports should be ideally presented to the whole class after which a collated picture of each existing system and its characteristics can be developed.
- Evaluation of student achievements can be based on the quality of reports produced and their individual presentation to the class. This exercise may be in the form of an assessment.
- Lectures and class discussions, posters and slides on principles and theory of productivity, sustainability and adoptability. Key question: What are the important indicators of productivity, sustainability and adoptability related to agroforestry systems? How can these be measured and determined?
- Field observation and discussion on agroforestry demonstration areas and villages practising an agroforestry system. Key question: What are the issues related to the criteria of a good agroforestry system observed and learned from the field?
- Field exercises to measure/determine productivity, sustainability and adoptability of an agroforestry system. This can be done after familiarizing the students with different methodologies for evaluating productivity, sustainability and adoptability, for example reading assignments on a particular report (evaluation reports or thesis) dealing with the topics.
- Case studies—through slides and/or videos

Bibliography

FAO, IIRR. 1995. Resource *management for upland areas in Southeast Asia.* FARM Field Document 2. Bangkok: Food and Agriculture Organization of the United Nations and Silang, Cavite: International Institute of Rural Reconstruction, Philippines.

Garrity DP, ed. 1997. Agroforestry innovations for Imperata grassland rehabilitation. *Agroforestry Systems* 36 (1-3) *Special Issue.* Dordrecht: Kluwer Academic Publishers. 284 pp.

Nair PKR, ed. 1989. *Agroforestry systems in the tropics.* Dordrecht, Netherlands: Kluwer Academic Publishers in cooperation with ICRAF.

Nair PKR, ed. 1993. *An introduction to agroforestry.* Dordrecht, Netherlands: Kluwer Academic Publishers in cooperation with ICRAF.

Chapter 6.

Institutions and policies related to agroforestry

Good and appropriate technologies are only part of the key to successful agroforestry development. Two other areas that need to be analysed are policies and institutions. Policies need to be conducive to empowering small-scale farmers and to the promotion of sound agroforestry activities. Policy constraints need to be properly considered and addressed. Supporting institutions at all levels are needed to give small-scale farmers strength, and to help encourage the adoption of appropriate agroforestry practices at the local level. This chapter includes the following topics:

- Institutional contexts
- Policies and programmes related to agroforestry

Institutional context

The institutional context is essential to natural resource management and agroforestry. A whole range of international, national, provincial and local institutions influence what happens in the field. To know which these institutions are and to understand what they do and how they interact is one key learning point in agroforestry education and training. The main categories of institutions with a bearing on agroforestry are discussed in this chapter.

Main learning points

- To appreciate that technologies are not enough—functioning institutions are also needed for agroforestry development and sustainable natural resource management.
- To be familiar with the important institutions of relevance to agroforestry and understand their roles or potential roles in developing and scaling up agroforestry innovations.

Contents

Government institutions

Many government agencies are involved in natural resource management and have rural development responsibilities. It is a common case that agroforestry falls in a no-man's land in the government structure, for instance, in-between the departments of forestry and agriculture. Alternatively, agroforestry might

be a domain for several government units and, therefore, prone to conflict of interest. Institutions to discuss in this context include:

- Government agencies with a mandate related to agroforestry and the function of those agencies in relation to agroforestry and natural resource management
- Government agencies involved in extension programmes related to natural resource management
- Government administration at various levels: national, regional and local (including provincial, municipal, district and village levels)

Non-governmental organizations (NGOs)

- Local, national and international NGOs involved in rural development and environmental conservation, etc.
- Overview of NGOs with a role in agroforestry development, and agenda and mandate as well as programme thrusts and priorities of those organizations
- Links, interactions and collaboration between NGOs, the government sector and local institutions and local people

Private sector

Characteristics of the private sector should likewise be dealt with in the agroforestry course (after all, most farmers are doing business with them, directly or indirectly!):

- Overview of the private business sector
- Entry points for involvement in the private sector of smallholders and village organizations
- The private sector links and functions in the rural areas
- Market forces and functions
- Local institutions in relation to the private sector
- Sharing of resources and the benefits from agroforestry development

Community-based formal and non-formal institutions

The importance of community-based and farmer-led organizations is increasingly recognized. These include people's or village organizations, farmers' cooperatives and other farmer-led organizations, labour unions, associations, clubs, federations, etc. They continue to show a great capacity for creating change, since they actually involve the local people, responding to their own needs, goals and desires:

- Identity and profile of existing community-based and farmer-led organizations
- Roles and functions in agroforestry development, including market development for agroforestry products; and in scaling up agroforestry innovations
- Roles in monitoring and evaluation of agroforestry programmes

Research *institutions*

The institutional context includes local, national and international research institutions, as well as educational institutions with a research mandate. It should be noted that increasing emphasis is being put on the participation of local people in research through on-farm experimentation. The importance of local knowledge in technology development and a two-way flow of knowledge between researchers and the local people are increasingly recognized today.

- Identity of research institutions with agroforestry mandate
- Research programme thrusts and priorities
- The emphasis on field-based research and on-farm participatory experimentation
- Agroforestry research and development links at all levels

Training and education institutions

Training and educational institutions—from primary and secondary schools up to universities and non-formal training institutions—are key institutions at local, regional and national levels:

- Their identity and roles in capability building through formal and non-formal courses
- Roles of training and educational institutions in research and technology development
- Extension programmes in training and education institutions

Bibliography

Catacutan DC, Mercado AR Jr, Patindol M. 2000. Modalities for scaling-up technology-dissemination approaches in natural resource management: Landcare and NRM planning process in Northern and Central Mindanao, Philippines. Paper read in CGIAR-NGO Committee International Workshop on Going to Scale: Bringing more benefits to more people quickly, 10-14 April 2000. Cavite: International Institute for Rural Reconstruction. 21 pp.

Garrity DP. 1999. Investing in a Future for Asia's upland poor: What we must do - Technical and Institutional Options. In *The Asian Crisis and the Rural Poor.* Proceedings of IFAD Symposium in Tokyo, p 42-52.

Garrity DP, Stark M, Mercado AR, Jr. 1999. Natural vegetative strip technology: A 'no cost' paradigm that may help transform tropical smallholder conservation. Paper presented

at The First Asia-Pacific Conference on Ground and Water Bioengineering for Erosion Control and Slope Stabilization, 19-21 April, 1999, at Manila, the Philippines, p 95-102.

Mercado AR Jr, Patindol M, Garrity DP. 2000. The landcare experience in the Philippines: Technical and institutional innovations for conservation farming. Paper presented during International Landcare 2000 Conference and Exhibition, 2-5 March 2000. Victoria: International Landcare. 15 pp.

Policies and programmes related to agroforestry

The policy and legal framework is of great importance for the sustainable management of natural resources. This section deals with the formal and non-formal policies and policy frameworks related to agroforestry, natural resource management and conservation, and with institutions involved in the formulation and implementation of those policies. What improvements in the policy framework are needed to make policies more supportive of agroforestry development?

Main learning points

- To be aware of the main laws and decrees that influence the management of natural resources in the country
- To understand the concept of tree and land tenure, including both the formal legal system and the traditional tenure systems
- To be familiar with policies related to land use, soil and vegetation, and socioeconomics, including trade and market policies
- To be familiar with national, regional and local development plans and programmes relevant to agroforestry and natural resource management

Contents

Lows and decrees

Laws and decrees in areas of importance to agroforestry and natural resource management, including those on:

- Forestry and agriculture including land tenure and land reform policies
- Nature and biodiversity conservation: national parks and other protected areas
- Decentralization, devolution and local governance in natural resource management
- International agreements and conventions with bearing on agroforestry, including the Convention on Climate Change, the Convention on Biological

Diversity, and the Earth Summit—the United Nations Conference on Environment and Development.

Plans and programmes

Generally, national laws and policies are translated into long-term plans and programmes for implementation through the concerned government agencies and institutions, with the expected support and cooperation of the local people:

- Relevant plans and programmes that have a bearing, directly or indirectly, on agroforestry. These plans and programmes are generally implemented through the ministries of agriculture, forestry, environment and natural resources, education, local government, agrarian reform, trade and industry, finance, etc.

Land and tree tenure

Land and tree tenure, both formal and informal, affect resource access and property rights in many rural communities. Thus, tenure issues often serve as major facilitating or constraining factors for sustainable natural resource management:

- Existing policies and state regulations related to land and tree tenure
- Formal policies and the indigenous traditional systems and analysis and reconciliation of differences

Economics

Since agroforestry is an activity for providing farmers with cash income, as well as products for subsistence, policies related to economics are vital. A range of economic policies—local, national or international—may facilitate or constrain farmers' opportunities to produce and sell agroforestry products:

- Market access and marketing mechanisms for agroforestry products
- Trade policies, such as trade tariffs, quotas, permissions and other types of trade control
- Credits and subsidies

Social aspects

Polices in the social area are also closely linked to agroforestry, since agroforestry is about people's management of the natural resources:

- Gender roles
- Ethnic minorities/cultural groups: traditional knowledge, practice and values; customs and practices that governs management of agricultural land (for example ancestral domains in the Philippines).
- Land conflicts and conflict resolution, including policies, rules and regulations governing encroachments on public forest land; migration and large-scale commercial activities; implications for forest inhabitants/occupants and private landholders.

- Human resources development for the agriculture/forestry sector: formal and non-formal training; job market for the graduates.
- Infrastructure and other social amenities, for example transportation, farm to market roads, post-harvest facilities, communication, health, education, extension, cooperatives, credit institutions, etc.

Methods

- Lectures and discussions supplemented by field visits
- Organize seminar/workshop with government officials and policy makers as resource persons to discuss/review status and needs of policies, plans and programmes
- Use of policy issues/concerns as topics for special studies and thesis research
- Placement of students in strategic projects/offices to expose them to the realities of policy implementation
- Case studies. Example: The teacher presents information regarding problems and constraints related to slow adoption of agroforestry and soil and water conservation technologies in a certain community-based forest management project site. Based on actual mid-term evaluation by external evaluators, the students (trainees) will be divided into smaller groups where each group is required to recommend strategies to address the identified problems or constraints. At the end of the exercise, all groups will reconvene where each group discusses its own recommendations, and the reasons behind each recommendation. Allot an open forum after each group presentation. When all groups have presented their outputs, ask the students which learning experiences they have gained and what more they need to know.
- Assignment: Students will be assigned to read a certain policy study report or programme evolution report and to answer a series of questions asked by the teacher. Their answers should be discussed if the following session.

Bibliography

Relevant policy and administrative issuances (will vary from country to country).

Fay C, de Foresta H, Sirait MS, Tomich TP. 1998. A policy breakthrough for Indonesian farmers in the Krui damar agroforests. *Agroforestry Today* 10 (2): 25-26.

Tomich TP, KuusipaloJ, Menz K, Byron N. 1997. Imperata economics & policy. In: Garrity DP, ed. Agroforestry innovations to rehabilitate imperata grasslands. 1997. *Agroforestry Systems* 36(1-3): 233-261. *Special Issue.* Dordrecht: Kluwer Academic Publishers.

Tomich TP, Thomas DE, van Noordwijk M, eds. 1999. *Research abstracts and key policy questions—Methodology workshop on environmental services and land use change.* Bridging the gap between policy and research in Southeast Asia. Workshop held in Chiang Mai University, Chiang Mai, Thailand from 31 May to 12 June 1999. ASB-Indonesia Report Number 10. Bogor: ICRAF.

Tomich TP. 1994. Putting 'slash and burn' in context: Socioeconomic and policy issues. In Sawit MH, ed. *Proceedings of methodology workshop on participatory rural appraisal,* Megamendung, West Java, 21-23 November 1994. ASB-lndonesia and ICRAF SEA, Bogor. 14pp. (Keynote address).

Chapter 7.

Advancing agroforestry practices

Advancing agroforestry practices includes both research and development (R&D) activities. R&D are not separated, but a continuum of collaborative activities with farmers and communities who play a critical role in sustainable natural resource management. Other stakeholders are also involved in this process.

Earlier top-down approaches to agroforestry interventions emphasized the role of experts in the government, NGOs and the academic institutions, but disregarded the significant participation of local people. This led to a lack of local, accurate and applicable information, and a lack of two-way communication between planners and local people. This, in turn, caused misunderstanding, mistrust and low adoption of interventions.

Advancing agroforestry practices, therefore, involves a dialogue with local farmers and other stakeholders in a revolving cycle of planning, generation, testing and implementation of innovations, and evaluation of the impact. Research is integrated in this cycle to generate solutions to problems and fill knowledge gaps.

To facilitate this development in extension and participatory technology development activities is an important task. The framework below illustrates the cycle of advancing agroforestry practices (figure 7).

This chapter deals with

- *Participatory planning:* A situation analysis to characterize the current status, diagnose the problems and design suitable research and development interventions.
- *Technology generation, testing and dissemination:* Participatory research and development activities to generate, test and disseminate agroforestry technologies, while taking into consideration the role of institutional options as well as policy options.
- *Monitoring and evaluation* to reflect on the process used, the impact of the research and development activities and the productivity, sustainability and adoptability of the agroforestry innovations.

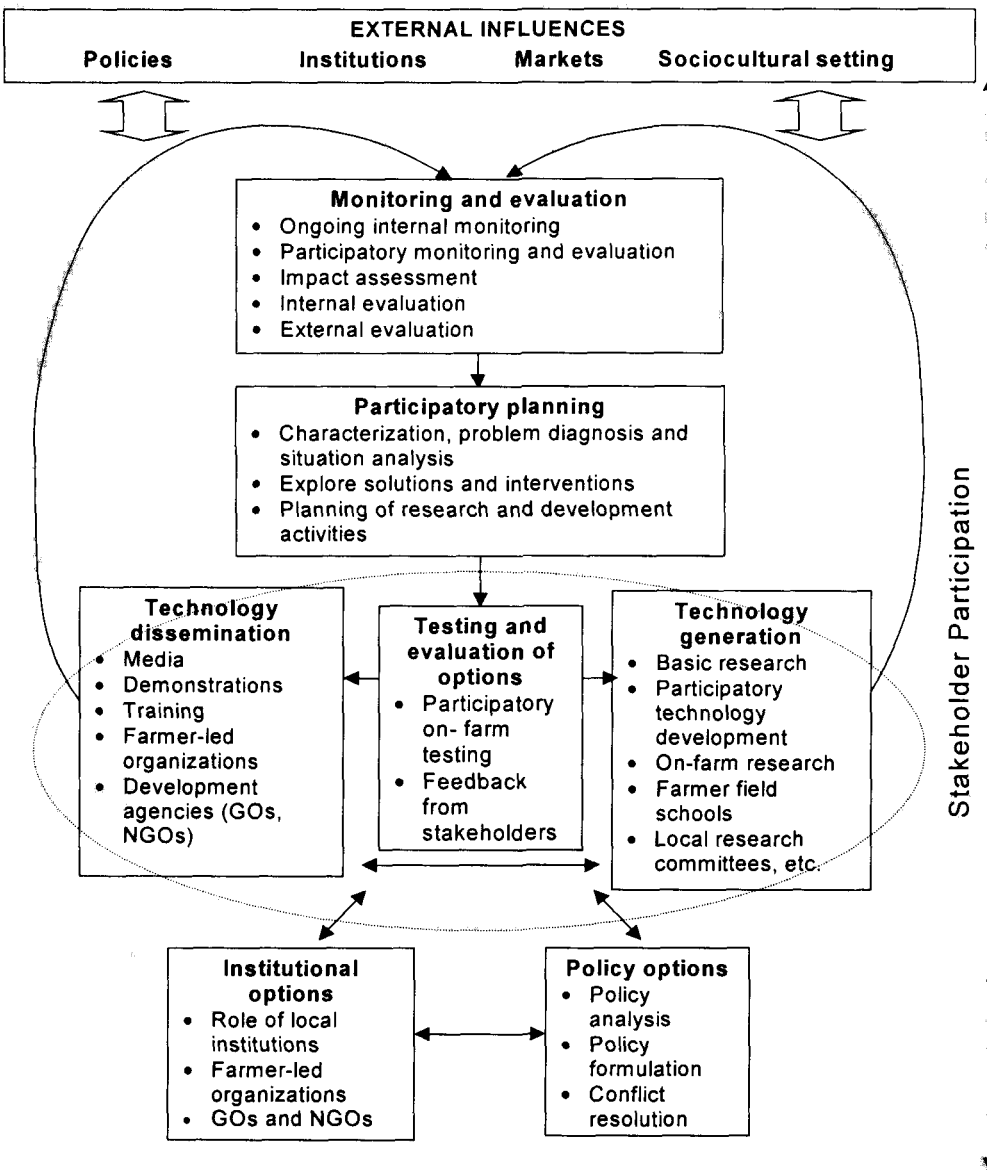


Figure 7. Advancing agroforestry practices.

Participatory planning for agroforestry

Planning is the process of preparing, in advance of action, and in a reasonably systematic fashion, recommendations for policies and activities so as to reach accepted objectives. In the agroforestry research and development context, planning is done using participatory tools, covering both biophysical and socioeconomic factors.

Main learning points

- To be familiar with the concepts of participatory approaches to community analysis, and the selection and use of appropriate planning tools
- To know how to carry out a characterization of biophysical and socioeconomic aspects in a community
- To diagnose problems and design appropriate agroforestry research and development innovations
- To set the boundaries for issues that the agroforestry team can address (for example not sanitation, health care, etc.)

Contents

Participatory methods and tools

A community analysis is required to examine interactions between the economic, social and biophysical systems. Participatory methods are used to collect and analyse community information. The analysis is normally carried out by interdisciplinary teams of, for example, researchers, extensionists and planners. This ensures that the local knowledge, skills and practices of farmers and local communities are fed into the process.

Participatory techniques also help mobilize and organize local people around issues they consider important. Local people analyse and make decisions based on the information they themselves provide. The learning is rapid, progressive and iterative (not a fixed blueprint). Information gathered could, for instance, provide a picture of the area, demonstrate current management issues and generate ideas on major constraints. In the agroforestry context, this enables local people to feel that they have 'ownership' and responsibility in the agroforestry programme. However, it is also important to understand that this may raise expectations that lie beyond what the agroforestry team can address (for example sanitation and health care, etc.).

A whole range of participatory tools for community analysis is available. They provide a 'basket' of tools and techniques for visualizing, interviewing and facilitating group work with farmers. The following are some of them:

- Farming Systems Research (FSR), an applied problem-solving approach conducted by multidisciplinary teams, with a degree of farmer-participation
- Agroecosystems Analysis (AEA)
- Rapid Rural Appraisal (RRA) uses a multidisciplinary approach, where specialists from different disciplines gather and analyse information as a team on a variety of technical subjects.
- Diagnosis and Design (D&D) is a methodology for the diagnosis of land management problems intended to assist agroforestry researchers and development field workers to plan and implement effective agroforestry innovations, particularly for agroforestry research.

- Participatory Rural Appraisal (PRA) methodology builds upon local people's capabilities, uses facilitation and participatory techniques, and empowers local people in the process.

Other planning tools that may be used in a participatory way include:

- SWOT analysis (strengths, weaknesses, opportunities, threats)
- Agroforestry Land Capability and Mapping System (ALCAMS)
- Geographical Information Systems (GIS)

Characterization and diagnosis

To arrive at a realistic plan for agroforestry research and development activities, it is necessary to conduct land use and farming household characterization and a problem diagnosis. Characterization is the description and analysis of agroecosystems in order to identify similarities and differences among these systems. Geographical boundaries and the principal components of the systems are identified. Interactions within and among systems are analysed based on ecological, economic, social and cultural criteria. This information is then used in a diagnosis of problems and constraints.

Data that may be gathered include *biophysical features:*

- Soil, climate, flora and fauna
- Topography and landform—slope and altitude, sun orientation and wind direction and wind force
- Water and hydrology
- Biological organisms—plants, animal, micro-organisms, aquatic life
- Land use practices and farming systems

Data that may be gathered also include *socioeconomic and cultural features:*

- Demographic profile: population size and structure, household categories, ethnic groupings, migration pattern
- Household composition and labour availability
- On- and off-farm household income; wealth ranking
- Gender
- Religion, beliefs, customs and traditions
- Economic factors: infrastructure, markets, support services (credit, farm supplies, research/extension)
- Preferences of food crops, cash crops and cropping calendar
- Land tenure and status, conflict resolutions
- Social problems (for instance related to health, education, accessibility, peace and order, illegal logging, slash-and-burn, etc.)
- Local organizations and institutions, leadership dynamics

Designing agroforestry interventions

The characterization and diagnosis is followed by the design of possible agroforestry interventions to address the discovered constraints. Simultaneously, research needs may be defined. The suggested options for agroforestry development and research are verified and evaluated in participation with farmers and communities. The output is an action plan of suggested agroforestry development activities, and identified research projects to address knowledge gaps.

As with characterization, several participatory tools and methodologies are currently in use to design improved and appropriate land use practices. All of these methodologies have the same essential features; each however has specific merits for specific situations. The designing tools need to cover three main areas:

- Options for agroforestry technology generation and dissemination
- Institutional innovations, in particular the role of farmer-led organizations
- Policy options and interventions

Methods

- Field exercises to conduct characterization, diagnosis and design. Students can test different approaches and report their findings in the class
- Conduct diagnostic field trips to gather experience from different agroforestry farms and models
- Brainstorming
- Group discussion
- Interviews

Bibliography

Del Castillo RA, Dalmacio R, Lasco R, Lawas N. 1994. *Agroforestry project planning and management (APPM). A training manual.* Philippines: UPLB, Agroforestry Program and Kapwa Upliftment Foundation.

Franzel S. *An introduction to farming household diagnosis.* ICRAF-DSO Introductory Training Course: 'Agroforestry Research for Integrated Land Use'. Nairobi, Kenya.

French J, Mathiesen U. 1995. *A framework for understanding agroforestry decision making at the farm household level.* Prepared by the FAO-Asia Pacific Agroforestry Network for the International Workshop on Agroforestry Investment Production and Marketing at the Indian Council of Forestry Research and Education, Dehradun Indoa, 17-26 September 1995.

Lai CK. 1999. Overview of participatory methods and techniques for agroforestry training and research. Paper prepared for a seminar organized by the University of the Philippines at Los Banos Agroforestry Program, 14 February 1994 and Participatory R&D Methods for Upland Agroforestry Systems and Watershed Resource Management in Southeast Asia, Philippines, from 31 May to 12 June 1999.

Nair PKR, ed. 1993. An *introduction* to *agroforestry.* Dordrecht, Netherlands: Kluwer Academic Publishers in cooperation with ICRAF.

Nguyen Van So. 1999. Objectives and methods of the participatory approach. Paper prepared for Participatory R&D Methods for Upland Agroforestry Systems and Watershed Resource Management in Southeast Asia, Philippines, 14-28, November 1999.

Weyerhouser H. 1999. Geographical information system (GIS): A manual to support the implementation of GIS. Chiang Mai: ICRAF.

Zeleke E, Temu AB, eds. 1999. *Introducing agroforestry: a teaching guide for the technical level.* Training and Education Report No. 45. Nairobi: ICRAF.

Technology generation, testing and dissemination

This section deals with activities that relate to facilitating agroforestry innovations on farmers' fields. The selection and application of the right approach to agroforestry technology dissemination and generation constitute the key to having an impact on farmers' fields. To work and learn with farmers in a participatory way is essential. There is no 'best way' of achieving this, because each case represents a unique set of problems, constraints and opportunities and requires a unique approach. For agroforestry 'innovations' or 'options' to have a wide impact, the key conditions are

- Appropriate agroforestry technologies
- Enabling policies
- Facilitating institutions

Each of these areas requires attention in the implementation of agroforestry research and development activities. While policies and institutions are dealt with elsewhere in this guide, this section deals with technology generation, testing of existing and new technologies, and dissemination.

Main learning points

- To be familiar with available agroforestry technologies and innovations and be knowledgeable about the inputs required, key management aspects and post-harvest production and marketing aspects.
- To be aware of the importance of local and indigenous knowledge
- To be familiar with Participatory Technology Development and other tools for technology generation and testing with farmers
- To understand key principles and methods for technology dissemination, using different extension methods and communication skills to advance agroforestry practices
- To maintain or improve the quality of agroforestry products by suitable post-harvest and processing techniques

Contents

Participatory agroforestry technology development

While some fundamental research is carried out in a researcher-controlled environment, most agroforestry research today is done on-farm. The degree of farmer involvement varies, but there is an increasing recognition that the relevance and applicability of the research will improve with a high degree of participation. There is also a continuous flow of knowledge and skills between research and development. To be able to apply participatory methods and work with farmers is therefore important.

The ethnic and cultural variation is great in Southeast Asia. A good starting point in agroforestry development is therefore, often, the farmers' indigenous knowledge. Starting with something familiar and moving on from there has a greater likelihood of success, rather than starting from scratch. The community analysis should provide the information on existing practices. The indigenous knowledge and technologies are further explored and developed and new technologies brought in and modified as appropriate, through a participatory technology development process:

- Agroforestry technology development as a participatory process, using appropriate research methods and tools, such as Participatory Technology Development (PTD)
- Combining indigenous practices and technologies and new technology innovations
- Identify, document and disseminate indigenous knowledge and technologies related to agroforestry and explore their production potential and constraints
- Plan and conduct participatory research project topics related to agroforestry

- Preparation of research proposals and protocol
- Experimental design and research implementation
- Communication skills and documentation skills
- Gathering and analysis of data
- Report preparation
- Monitoring and evaluation

Technology *testing with farmers*

Technologies are tested and verified in participation with farmers and other stakeholders, and the biophysical and socioeconomic performance and possible adoptability of technologies are evaluated. The testing, verification and evaluation include

- Farmers' preferences
- Labour requirements
- Identification of potential 'bottle-necks'
- Gender analysis
- Financial and economic analysis, and estimation of costs and benefits of agroforestry systems (various evaluation criteria: net present value (NPV), internal rate of return (IRR), benefit/cost ration (B/C), return on investment, pay-back period).
- Rural credit system analysis

Technology dissemination

When existing or improved agroforestry innovations have been tested with farmers, dissemination, or 'scaling-up' follows. Providing an expanded range of options for farmers is a key component in agroforestry dissemination. This may lead to a greater diversity of farm activities. Diversifying the farming activities adds income, spreads risks and can provide better food and nutritional security. What happens after the harvest of agroforestry products, often, has a significant importance for the overall output or income. Post-harvest techniques and processing of agroforestry products are therefore important aspects of technology dissemination. Technology dissemination includes a wide range of technical as well as process-based competencies:

- Select and apply appropriate agroforestry options and livelihood projects, including post-harvest and processing techniques.
- Marketing aspects related to agroforestry products: conducting market surveys and assessing of market demand, and methods to label and promote finished agroforestry products.
- Entrepreneurship
- Practical skills related to training topics in the community, for example, seed production and nursery management, bee keeping, sericulture, mushroom production, poultry raising, food processing, aquaculture, etc.

- Methods and approaches to transferring agroforestry options in an appropriate way: extension and communication methods and skills; farmer-based extension methods.
- Farmers' organizations, which can support the dissemination process
- Planning and implementation of agroforestry extension
- Continuous monitoring and evaluation of agroforestry extension

Methods

- Brainstorming, group discussion
- Computer analysis
- Practical field exercises ('practicum')
- Field trips on manufacturing agroforestry products and agroindustries
- Field visits
- Group discussions
- Interviewing farmers
- **Role-play**
- Visiting and interviewing farmers, middlemen, and sellers to be able to compare the prices
- Visiting demo-farms

Materials

- Case study examples
- Example proposals
- Examples of research proposals
- Guidelines
- Handouts, sample of feasibility studies
- Manuals

» Visual materials (slide series, video), manuals, guidelines, examples

Bibliography

Ashby JA. 1990. *Evaluating technology with farmers: A handbook.* CI AT Publication no. 187. Apartado Aereo 6713, Cali, Columbia. 95 pp.

Coe R (compiler). 1999. Checklist for protocols for experiments with farmers. Prepared by participants of a workshop on participatory experimentation, African Highlands Initiative, Nairobi, 28June-3 July 1999.

Coe R, Franzel S. 1995. Designing on-farm experiments. Report of a workshop held at ICRAF, Nairobi, Kenya. 26-29 June. 91 pp.

FAO, IIRR. 1995. *Resource management for upland areas in Southeast Asia.* FARM Field Document 2. Bangkok: Food and Agriculture Organization of the United Nations and Silang, Cavite: International Institute of Rural Reconstruction, Philippines.

Franzel S. 1999. Use of an indigenous board game, 'bao', for assessing farmers' preferences among alternative agricultural technologies. ICRAF. Submitted to Agricultural Economics. 16 pp.

Garrity DP, Mercado A, Stark, M. 1998. *Building the smallholder into successful natural resource management at the watershed scale.* ICRAF Southeast Asian Regional Research Programme. 10 pp.

Gordon JC, Bentley WR. 1990. *A handbook on the management of agroforestry research.* India: Winrock International and South Asia Books, India. 72 pp.

Hensleigh TE, Holaway BK, eds. 1998. *Agroforestry species for the Philippines.* Manila: The US Peace Corps. 404 pp.

Hsiung XW, Chandler PF, eds. 1996. *Agroforestry research and practice.* China: China Forestry Publishing House. 319 pp.

Huxley P, Van Houten H, eds. 1997. *Glossary for agroforestry.* Nairobi: International Centre for Research in Agroforestry. 108 pp.

UPLB Agroforestry Program (now Institute of Agroforestry). 1994. *Technology verification through on-farm trials (TVOFT).* College, Laguna: UPLB and Kapwa Upliftment Foundation. 187 pp.

Monitoring and evaluation

Monitoring and evaluation are an integral part of a programme cycle. Monitoring is a continuous internal process of information collection, recording and reporting in an ongoing programme. Evaluation is a process for assessing the performance and output of a programme or activity. The evaluation tests the conformity vis-a-vis the agreed plan, provides feedback for improving ongoing activities, and assists management in future planning.

In the case of agroforestry, evaluation is particularly linked to impact at farmer level. Testing and evaluation of options are done with farmers as an important step, before dissemination and technology generation take place (figure 7 above).

After implementing the agroforestry innovation, monitoring and evaluation should be taken into account. Since the basic attributes or goals of all agroforestry systems are productivity, sustainability and adoptability, the monitoring and evaluation must consider those attributes.

This section will outline the development of a methodology for evaluating and monitoring agroforestry innovation.

Main learning points

- To appreciate the needs for monitoring and evaluation as part of programme implementation

- To be familiar with the most common methods and tools for monitoring and evaluation
- To be able to integrate monitoring and evaluation within an agroforestry innovation activity

Contents

Background to monitoring and evaluation

- Define monitoring and evaluation, and explain the similarities, differences and relationships between the two processes
- Discuss the advantages of monitoring and evaluation in a programme/project

Evaluation principles

- *Productivity evaluation:* Express the productivity of the different outputs in measurable, quantitative and meaningful terms, for example, quantity and quality of the produce. Other examples of measurements are for instance: Land Equivalent Ratio (LER.) and Harvest Index (HI).
- *Sustainability evaluation:* Define sustainability in the context of agroforestry interventions. Discuss criteria and indicators for sustainability. Are the agroforestry interventions sustainable from biophysical, ecological/environmental, social and economic points of view?
- *Adoptability evaluation:* Indicate the adoption of the agroforestry innovations by farmers. Set up the criteria and indicators of agroforestry adoption. List and discuss biophysical and socioeconomic factors affecting the adoption of the innovations.

Evaluation of agroforestry innovations

- Discuss the role of evaluation of an agroforestry innovation, and suggest the procedure for how an evaluation could be conducted
- Criteria and indicators to be included for evaluating an agroforestry innovation: social relevance (suitability), profitability, versatility and creativity, and longevity and reliability.
- Questionnaire to conduct the evaluation

Methods and tools

- Discuss the overall goals of the agroforestry innovation, and discuss suitable methods and tools for monitoring and evaluation, including for example: participatory monitoring and evaluation (PME); impact assessment; environmental impact assessment (EIA); external and internal evaluation.
- Brain storming
- Field visits to farmers
- Group discussions

Materials

- Manual
- Case study example

Bibliography

Ashby J A. 1990. *Evaluating technology with farmers: a handbook.* CI AT Publication no. 187. Apartado Aereo 6713, Cali, Columbia. 95 pp.

Franzel S. 1999. Use of an indigenous board game, 'bao', for assessing farmers' preferences among alternative agricultural technologies. Nairobi: ICRAF. 16 pp.

Okali C, Sumberg J, Farrington J. 1994. *Farmer participatory research: rhetoric and reality.* London: Intermediate Technology. 159 pp.

Glossary

Agroecosystem	A systems view of a farming enterprise in a landscape context, including physical, environmental, economic and social factors.
Biodiversity	The variety of life on earth, including all plants, animals, micro organisms, the genes they contain and the complex ecosystems they help form.
Carbon-stock	Carbon stored in vegetation or soil (above ground standing biomass, under-storey, litter, roots and soil organic matter).
Catchment area	The area of land contributing to the flow of a specific stream or river.
Ethnological diversity	The variation in ethnic groups or communities in a given region, with their differences in perception, knowledge, values and resources.
Evaluation	A process of assessing and monitoring results for conformity with agreed objectives in order to improve ongoing activities and better plan future ones.
Leaching (of nutrients)	The dissolving and washing away of nutrients (e.g. down the soil profile by the action of rain water).
Microclimate	The specific climatic conditions as found in small areas, for example, around plants.
Mineralization	The conversion of an element from an organic form to an inorganic state as a result of microbial decomposition.
Monitoring	A continuous process of information collection, recording and reporting.
Mulch	A non-mineral layer on top of a soil profile, usually consisting of plant residues, that reduces the direct impact of rain, sun or wind on the soil.

Mycorrhiza	A fungus-plant association in which fungal structures inside or directly around a plant root are connected with hyphae exploring the soil.
Nutrient pump	A deep tree root system, that takes up nutrients in deep soil layers and brings them to the surface in the tree and its litter fall.
Resource capture	The processes by which plants obtain light, water and nutrients.
Root channel	A channel formed by a decayed root.
Safety-net for leached nutrients	Deep tree root systems that take up nutrients that have been leached down the soil profile, out of reach of crop roots.
Slash-and-burn system	A technique for land clearing to prepare for planting of annual food crops or trees. The term is also used as a synonym for 'swidden' cultivation and 'shifting cultivation' where cropping periods alternate with a fallow period during which natural vegetation can reclaim the land.
Soil organic matter	Material found in soil derived from living matter; it includes labile and stable forms.
Sustainable land use	Land use that maintains productivity of the land while conserving or enhancing the resources on which future production depends.
Watershed	Originally the boundary between two catchment areas. Currently often used as synonym of catchment area.

Annex 1. List of organizations

A range of resource materials and information is available from national and regional organizations—often free of charge. Some of these organizations are mentioned below. The Internet is also an excellent source of materials. But since it is constantly being updated, we have not provided specific addresses; we do recommend that you visit the sites of major organizations such as the International Centre for Research in Agroforestry (ICRAF), United Nations Food and Agriculture Organization (FAO), and others.

The following list of organizations in Southeast Asia might be helpful for agroforestry curriculum development purposes:

Regional Organizations

FAO Regional Office for Asia and the Pacific
39 Phra Atit Road
Bangkok 10200 Thailand
Tel: +662281 7844
Fax: + 66 2 280 0445

Regional Community Forestry Training Centre (RECOFTC)
Kasetsart University
PO Box 111 I
Bangkok 10903 Thailand
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Fax:+ 66 2 561 4880

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SEAMEO Regional Centre for Graduate Study and Research in Agriculture (SEARCA)
College
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International Institute for Rural Construction (IIRR)
YC James Yen Centre
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HELVETAS-Social Forestry Support Programme
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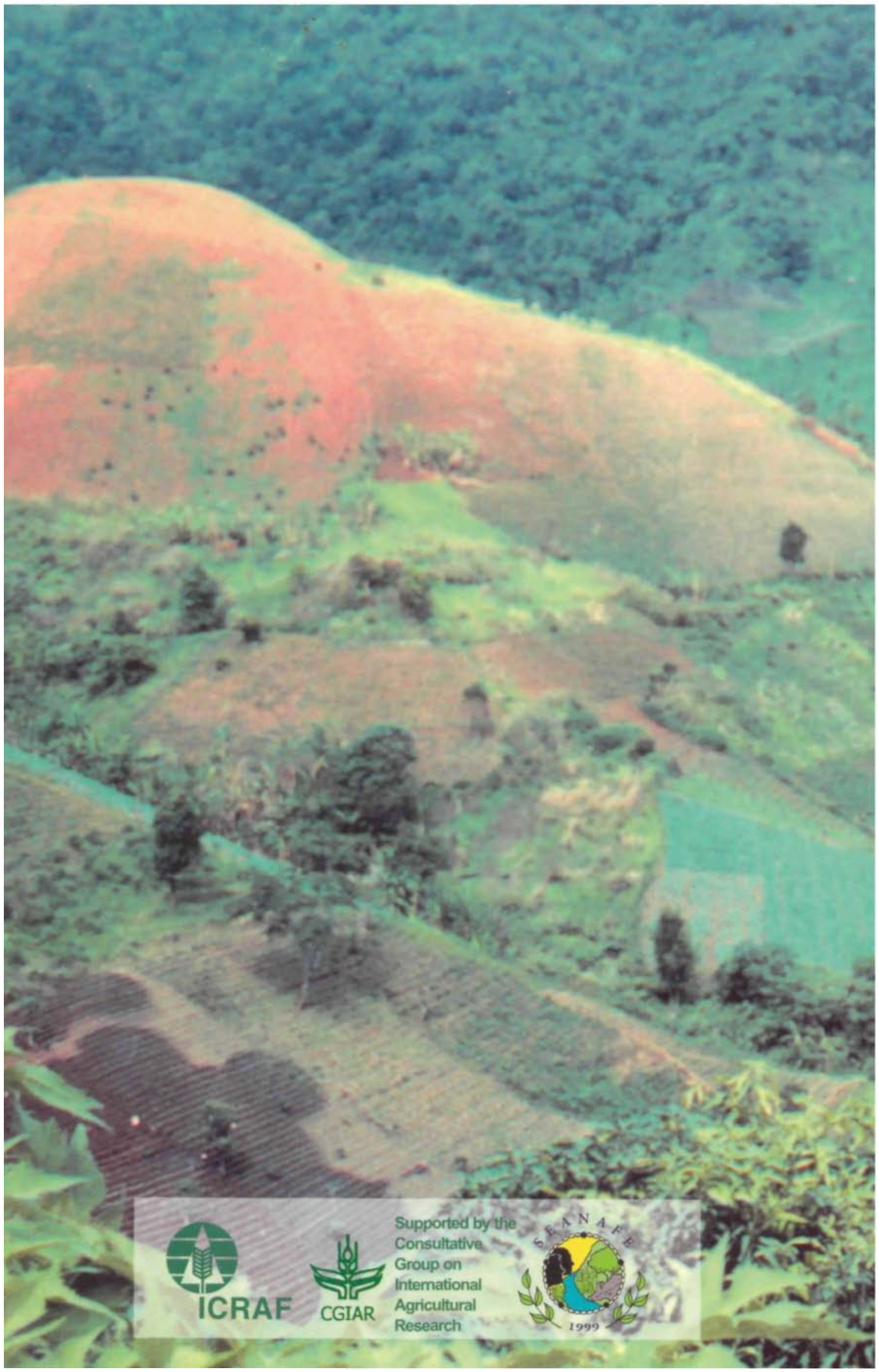
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Supported by the Consultative Group on International Agricultural Research
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