Developing Agroforestry Curricula

A Practical Guide for Academic Institutions in Africa and Asia

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World Agroforestry Centre

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Preface

Agroforestry is being rapidly incorporated into the curricula of many universities and colleges. Due to its integrative nature, agroforestry is easily linked with many aspects of land use, including agriculture, horticulture, forestry and environmental management. Other fields concerning human behaviour and development, such as the social sciences, also fit into agroforestry.

There is much debate about how best to teach agroforestry. Current experiences show that it ranges from a topic within a subject area to a fully-fledged programme resulting in agroforestry degrees. This is to be expected because agroforestry, though an old practice, is a young and rapidly growing area of science and technology.

The authors of this guide promote a pragmatic approach to development of agroforestry curricula. Rather than presenting a possible list of components or modules, they have applied a conceptual framework which allows deeper thinking on the purpose and nature of the subject. This approach provides the flexibility necessary to tailor agroforestry education to the social, cultural and environmental conditions in which it is taught. At the same time, the subject remains anchored on solid principles that are well illustrated in the guide.

I am sure that stakeholders in agroforestry teaching and learning, whether in colleges, universities or other institutions, will find the guide both stimulating and practical.

Prof Mohamed H A Hassan
President of the African Academy of Sciences and Executive Director of TWAS, the Academy of Sciences for the Developing World

Acknowledgements

Acronyms

AFTPs	Agroforestry tree products
ANAFE	African Network for Agriculture, Agroforestry and Natural Resources Education
CAMES	*Conseil Africain et Malgache pour l'Enseignement Supérieur*
CD	Curriculum Development
DACUM	Developing a Curriculum
FAO	Food and Agriculture Organization of the UN
ICRAF	World Agroforestry Centre
INRM	Integrated Natural Resource Management
MDG	Millennium Development Goals
NGO	Non-government organization
NTFPs	Non-timber forest products
PCD	Participatory Curriculum Development
SEANAFE	Southeast Asian Network for Agroforestry Education
UN	United Nations
UNESCO	UN Educational, Scientific and Cultural Organization

Foreword

Is there a need for a new curriculum development guide?

Twenty-five years ago, very few educational institutions taught agroforestry. By 2005, the number of universities and colleges now teaching agroforestry has grown into the hundreds. Clearly, these institutions have developed their agroforestry curricula relatively recently. And still more institutions continue to introduce new agroforestry programmes.

Consequently, agroforestry has become a subject or even a full programme at universities and colleges throughout the tropics, as well as in some subtropical and temperate countries. Not only has agroforestry education increased in terms of the sheer number of courses and programmes, it has also become a component of programmes such as environmental conservation and rural development.

That is good news for sustainable development. But the job of introducing agroforestry as a mainstream subject is far from complete; **many agroforestry curricula currently in use need revision** in the light of our expanded understanding of the subject, and because the varied settings in which agroforestry is practiced keep changing. The primary aim of this guide is to facilitate teaching institutions in the development and review of agroforestry curricula.

Building on past experiences

The monograph 'Approaches to agroforestry curriculum development' was first published by the World Agroforestry Centre (ICRAF) in 1995 (Temu and others 1995). By the time of that first edition, agroforestry was already being taught in leading institutions. However, many others wanted to introduce the subject but lacked guidance on how to go about it.

The monograph sought to meet this need by suggesting methods and processes to produce good agroforestry curricula. The guide proposed a curriculum framework which included three main components: a) agroforestry principles, b) agroforestry practices, and c) research and

development. The guide proved useful in inspiring institutions to develop and review their teaching practices. Since then, 68 curricula in Africa have been revised to incorporate an agroforestry component. This **2nd, fully revised, edition** draws on the experiences of these institutions, all of which are members of the African Network for Agriculture, Agroforestry and Natural Resources Education (ANAFE).

In Southeast Asia, where a similar regional agroforestry education network was established in 1999, more than 20 curricula have been revised in recent years using 'A guide to learning agroforestry' (Rudebjer and others 2001). The experiences of the Southeast Asian Network for Agroforestry Education (SEANAFE) have also contributed to the current revision of the guide.

Similarly, many universities and technical colleges in South Asia, Europe, Australia, Latin America and North America have developed agroforestry education at three different levels: as a stand-alone degree or diploma programme, as a core or elective subject within various programmes, or as a single topic in other subjects.

As agroforestry education has expanded, so too has agroforestry research. International research centres such ICRAF, as well as national research institutes and universities, conduct growing numbers of studies on agroforestry and integrated natural resource management. This large body of **knowledge has broadened our view of 'agroforestry',** which now incorporates marketing, environmental services, analysis of complex fragmented landscapes, the socioeconomics of rural livelihoods, and natural resource management policy and governance. There are many others. A second aim of this guide is therefore to encourage the inclusion of these new fields and findings into agroforestry education.

Unsurprisingly, the content and delivery of agroforestry curricula are highly variable, because they are intended to meet wide ranging needs. The environment in which agroforestry is practised ranges from semi-arid to humid tropical. The institutional setting in which agroforestry is taught ranges from farmers' learning centres to universities. Likewise, institutions teach agroforestry in a wide variety of ways, from treating it as a topic that only requires a few contact hours, to providing a full, multiyear master's programme.

The diversity seen in the subject points to a large degree of flexibility in modern agroforestry teaching and learning. It also means there is little room for a curriculum development manual to be prescriptive. In this 2nd edition, we focus more on process than content, building on experiences from research, education and farm practice. Yet agroforestry is a complex and knowledge-intensive subject that benefits from strong links between several biophysical and social sciences. Thus multidisciplinary arrangements and cooperation among institutions are essential for the success of teaching and learning agroforestry, and these we highlight where necessary.

How to read this guide

We promote the view that agroforestry is not only a set of practices, but also about the processes in society that influence, and are influenced by, those practices.

Recent advances in participatory approaches are heavily influencing rural development paradigms and, in consequence, must also influence agroforestry teaching. By seeking the participation of farmers and other stakeholders, institutions are able to develop and deliver more relevant education programmes. We endorse and recommend the participatory approach here.

Institutions use the terms 'subject', 'module' and 'course' interchangeably to describe the components of an education programme. For the purpose of clarity, we consistently use the term 'subject' in this guide.

The term 'curriculum' is here used to describe all the teaching and learning content and processes that lead to a desired competence in learners. Thus we interpret 'curriculum' as a much wider concept than merely course subject matter.

While agroforestry is taught in tropical, subtropical and temperate regions, this guide primarily targets users in developing countries, particularly those in Africa and Asia. However, institutions in other regions may also find it useful.

The guide is organized into five Chapters. In Chapter 1, our **introduction** briefly looks back at agroforestry innovations over the past 25 years, and discusses different concepts of agroforestry and

multifunctional landscape mosaics. We then look at the different scales of agroforestry research and development.

Global experiences in agroforestry education are summarized in Chapter 2. After an overview of the history of agroforestry education, we discuss the diverse teaching approaches employed at different technical and professional levels. We then point out some of the common shortcomings of existing curricula. Finally, we briefly explore how the job market for agroforestry graduates has developed.

Chapter 3 presents some commonly used **methods for curriculum development**. The participatory method is then discussed in some detail, because experience suggests that the participation of farmers, employers and other stakeholders helps create more relevant and applicable curricula.

Agroforestry curriculum development is then discussed in Chapter 4. Based on the various processes available, we suggest a set of seven requirements for the planning and implementation of a curriculum development project. Methodologies for a simple training needs analysis and a stakeholder analysis are also provided.

In Chapter 5, we present a **framework for agroforestry curricula**. This is intended to guide the content development within an agroforestry education programme, subject or topic. At the centre of the framework are farmers' decisions related to the agroforestry production cycle: overall management, the products and services produced, and the use and marketing of these outputs. We present a model of how these decisions are influenced by biophysical and socioeconomic conditions, and how agroforestry practices may impact on people and landscapes. We also discuss risks and potential challenges, and how policies and governance relate to agroforestry.

Finally, we offer some additional resources. Firstly, we present **Internet resources** related to agroforestry, natural resources management and education. Secondly, Annex 1 presents a quick reference summary of the complete **agroforestry curriculum framework.**

> 'Being really good at "learning how to learn" will be an enormous asset in an era of rapid change and innovation, when new jobs will be phased in and old ones phase out faster than ever'
>
> *Thomas L. Friedman*
> *International Herald Tribune, May 7-8, 2005*

Chapter 1. Introduction

Twenty-five years of agroforestry innovation

In only a handful of years, agroforestry has gone from being an innovative but little noticed practice of smallholder farmers, to being a widely recognized system of agricultural production and natural resource management. As the research community increasingly studies how agroforestry relates to **sustainable livelihoods and landscapes**, it has earned the respectability of a science.

As a young science, its horizons are being rapidly expanded by **research**. Thus an increasing range of agroforestry innovations and options are becoming available to farmers, planners and managers. For example, improved understanding of the environmental impacts of agroforestry shows the contribution it can make to soil conservation, improved biological diversity on farms, the regulation of water quality and flow in agricultural landscapes, or the prevention of floods and other natural disasters. These wider impacts have linked agroforestry land use to policies and governance at local, regional and international levels. In effect, decisions made by farmers are important to society at large. We are all connected. And policy makers are taking note. Indeed, agroforestry is now included in development and environmental policies in many developing countries. As society changes its view of agroforestry, so must education.

A second important development in agroforestry is commercialization, and agroforestry is growing as a business in its own right. **Marketing of agroforestry tree products and services** has become an increasingly important area of research and innovation. Payments or other compensations for environmental services, as well as initiatives in ecotourism, offer new opportunities for rural communities. All of these developments have a bearing on how agroforestry is now conceived – and how it is taught.

Curricula need to capture the trends that agroforestry science and practice have revealed. Such **trends** include a shift in emphasis:

- From considering agroforestry systems at plot and farm level towards analysis at the landscape level.

- From seeing agroforestry systems as subsistence production towards looking at their business, marketing and entrepreneurship aspects.
- From focusing solely on technologies towards integrating socioeconomic factors including land tenure, gender and ethnic diversity.
- From promoting 'technology transfer' of agroforestry 'models' towards shared learning and the participatory development of agroforestry options and innovations.
- From focusing on local land management towards including environmental impacts and policy considerations at more diverse scales, from local to global.

Agroforestry trees and land use

While most of us have a clear understanding of what forestry or agriculture are, 'agroforestry' is more complex. Our current definition of 'agroforestry' evolved over a number of years, and sees it as a dynamic, ecologically-based, natural resources management system that integrates trees on farms and in the agricultural landscape in order to diversify and sustain production (Leakey and others 1996). The interest in promoting agroforestry derives from its (potential) social, economic and environmental benefits for all land users. But there are some factors that make agroforestry a challenging concept to capture.

One challenge is the sheer range of land uses that might be considered as agroforestry. This situation makes **agroforestry land use statistics unclear**, or even absent. Most global and national inventories fail to identify 'agroforestry', because agroforestry usually does not have land of it's 'own' – an issue we discuss in more detail later in the chapter. Some elements of agroforestry clearly get measured as 'forest', such as the late fallow stage of rotational shifting cultivation, or the rubber and dammar agroforests of Southeast Asia. Many other agroforestry practices are recorded as 'agriculture', for example when high-value trees are grown in the crop fields, as in Chagga home gardens on the slopes of Kilimanjaro, where *Albizia maranguensis*, *Bridelia micrantha*, *Croton macrophylla* and *Perses americana* and others produce fruit, fodder, firewood and medicine. In some cases, however, land under agroforestry is identified only as 'degraded land' or 'plantation', as coffee agroforestry systems often are, or yet more simply as 'other land use'.

The UN Food and Agriculture Organization's (FAO) Forest Resource Assessment, tries to remedy the measurement problem by using the term 'trees outside forests'. This category includes scattered trees on farms, forest stands smaller than 0.5 hectares, small gallery forests and trees in urban environments (FAO 2005). But trees outside forests remain notoriously difficult to measure, and data are scarce.

Sometimes the term 'trees on farms' is used, reflecting the growing of trees within the farm boundary. This categorization would also include woodlots located on farms, which may show up in some classifications as 'forest' if large enough. However, 'trees on farms' does not include agroforestry practices elsewhere, such as on communal lands or in rotational fallow systems, and is therefore too narrow a definition for some uses.

The overall result is that there is no widely accepted functional definition of 'agroforestry' that allows it to be measured as a land use on a large scale. Agroforestry is therefore largely invisible in most countries' land use data, and its importance is consistently underestimated.

A second challenge with agroforestry definitions is agreeing on a term that covers all of the specific species involved, independently of where they grow, how they are established or what they are used for. Clearly, trees exist naturally in agricultural landscapes; these are often retained and managed in agroforestry systems. Others are planted in a range of tree-crop combinations. Both are examples of domestication of agroforestry trees, where species are brought into wider cultivation through a farmer-driven and market-led process (Simons 2003). The term 'multipurpose trees and shrubs' has often been used to capture this diversity. But not all trees and shrubs in agroforestry systems have multiple purposes in the eyes of the farmer. There is also some confusion with the term 'non-timber forest products' (NTFPs), which involves extraction from forests, because the same species can also be grown outside forests.

The generic term **'agroforestry trees'** has recently been suggested as a way to clarify these issues. In this definition, the products of domesticated agroforestry trees should be called **'agroforestry tree products'** (AFTPs) to distinguish between wild and domesticated products (Leakey and Simons 2004). Both terms are intended to cover the whole spectrum of trees and shrubs found in agroforestry systems.

Accordingly, 'agroforestry trees':

- Provide valuable products such as timber, food, fodder, medicines, materials for local handicraft, essential oils and incense. Enterprises based on agroforestry trees are increasingly a source of cash income to farmers.
- Provide environmental services, such as erosion mitigation, soil nutrient cycling and soil fertility improvement, carbon sequestration, improved biological diversity in agricultural landscapes, watershed functions and improved landscape aesthetics.
- Help avert or mitigate farming risks, such as by improving the microclimate, diversifying farming practices and allowing off-season production of food and fodder, or by allowing for more productive distributions of labour.

Despite these potential benefits, a poor choice of tree or shrub species, or poor management, can prove disastrous. Some species are invasive and easily become pernicious weeds. Others have a luxury consumption of water and nutrients, or allelopathic qualities, meaning that they retard the growth of crops and other plant species. Poisonous trees and shrubs can be a risk to humans and animals. The presence of trees can obstruct farm mechanization. Trees might also attract birds, insects and other animals, both useful and destructive. All of these factors determine the impact of species selection on the overall costs and benefits of agroforestry production systems. Thus, choices of species and management systems that are guided by proven knowledge and experience can avoid many potential problems.

Agroforestry science is unravelling the complex issues relating to the choice, domestication and management of agroforestry trees, the uses

and marketing of their products and services, and their contributions towards poverty alleviation and improved environmental functions. As the science of agroforestry grows, educators are rethinking how to teach it.

Fruit trees are popular in agroforestry systems as they provide both cash income and food

Landscapes, scales and complexity

An integrated approach is rapidly becoming the accepted best practice for understanding and explaining how agroforestry systems work. To work well, this approach requires the different elements of knowledge encapsulated in agroforestry to be recognized. Agroforestry can then be considered in the context of other sciences, both biophysical and socioeconomic.

An integrated systems approach thus provides a practical framework within which to see the complexity of agroforestry systems. And it specifically illuminates four features of agroforestry systems that were previously overlooked, but which now need to be considered in agroforestry curricula.

The first feature of this understanding of agroforestry is that it examines land use in terms of **landscape mosaics**, thereby questioning the institutional and conceptual separation of forestry and agriculture. This artificial dichotomy puts a number of constraints on our understanding, yet most governmental organizations and higher education institutions are set up as if the distinction was real and obvious.

The agroforestry landscape mosaics idea (figure 1) recognizes that agroforestry does not have land of its 'own', at least in any useful, measurable sense. Instead, agroforestry appears to 'encroach' on agriculture and forestry land. The overlap in the diagram illustrates that agroforestry is linked to agriculture and forestry, rather than being an independent land use system. The arrows indicate change, as land use shifts over time. The overlap between the two spheres may be small or large, reflecting the proportion of land used for agroforestry.

The model in figure 1 is an attempt to explain what we see in the real world, where rural landscapes are typically a dynamic patchwork of crops, meadows and grasslands, forest woodlots and agroforestry trees. Such 'integrated', real-world land use differs in many respects from the 'segregated' landscapes upon which many education programmes are built. Put simply, landscapes, especially in the developing world, are almost never covered in neatly quantifiable blocks of forest and agriculture with clear boundaries between them.

In consequence, academic programmes in natural resources management need reorientation, from division into highly specialized

subjects towards greater integration of subjects. They must also provide 'learning processes' so students can solve complex, real-world problems. Programmes in farming systems and environmental conservation are such examples. Agroforestry, too, is a suitable subject for such process-based teaching and learning.

Permanent agriculture

Agroforestry 'mosaic' landscape
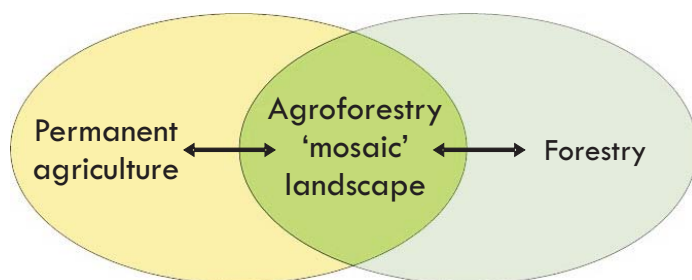
Forestry

Figure 1. Agroforestry land use is linked to both agriculture and forestry.

A second feature of the integrated systems approach concerns **'scales'**. Early agroforestry education usually focused at the plot or farm level, but did not much consider interactions within the broader landscape. They also missed the important trade-offs that are made between agroforestry and other land uses. An integrated systems understanding of landscapes implies that farmers undertake a wide diversity of activities in many disciplines, and that local land use decisions have impacts off farm, such as impacts on environmental services. To capture these interactions, agroforestry research now considers multiple, interacting, scales (figure 2). These dimensions of agroforestry need to be taught in universities and colleges.
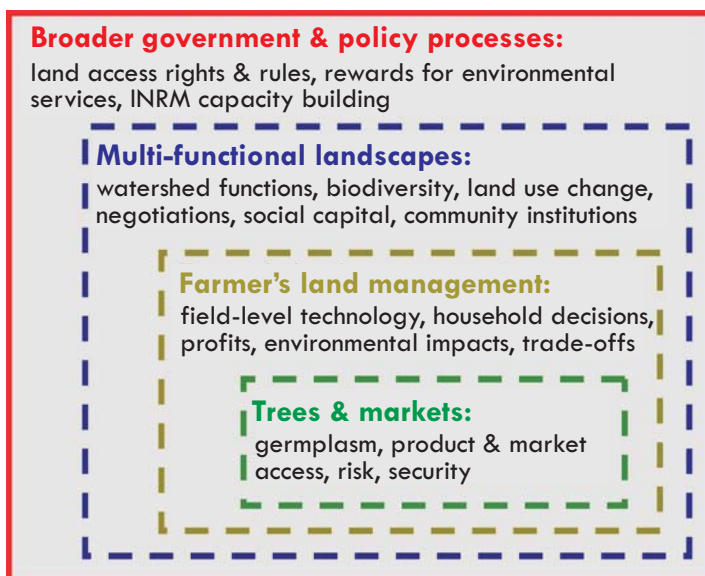
Broader government & policy processes:
land access rights & rules, rewards for environmental services, INRM capacity building

Multi-functional landscapes:
watershed functions, biodiversity, land use change, negotiations, social capital, community institutions

Farmer's land management:
field-level technology, household decisions, profits, environmental impacts, trade-offs

Trees & markets:
germplasm, product & market access, risk, security

Figure 2. Reforming agroforestry research and development approaches.
Source: ICRAF Southeast Asia

A third important feature of our current understanding of agroforestry is **participation of stakeholders**. Here the focus is particularly on farmers and their institutions, such as farmers' associations, women's groups, NGOs, local government units and perhaps even churches and schools, among many others. A wide body of research and experience from rural development shows that participation makes interventions more effective and sustainable. This conclusion is equally applicable to education. By grounding agroforestry teaching in the local knowledge and knowledge needs of farmers, the relevance and quality of the teaching and learning process is enhanced.

The final feature of modern agroforestry concepts is the integration of disciplines, with **multidisciplinary approaches** being the natural result. To capture the different elements of integrated landscapes and livelihoods, biophysical and socioeconomic specialists must work together. Social forestry, community forestry, agroforestry, farming systems research and so on, all help clarify how people and landscapes interact. Inter- and multidisciplinary approaches are essential ingredients to effective agroforestry education programmes.

One obvious consequence of greater integration between disciplines is a growing desire to improve synergy between different land use programmes, primarily because policies and actions in one discipline can have irreparable repercussions in others. A good example of the need for synergy is the omission of tree seed education in agricultural curricula (Holding-Anyonge and others 2005). It is hard to see how agricultural 'experts' would be able to advise farmers on tree planting and management if they have no training in tree seed science and technology. If this situation is not remedied, the potential to enhance ex-situ biodiversity conservation on farmland will be compromised. Foresters and agronomists can clearly make more progress if they integrate knowledge from both disciplines. Similar lessons can be learned from the integration of biophysical and socioeconomic disciplines.

Agroforestry can enhance the quality and relevance of education in land use by bringing together agriculture, forestry and environmental management, as well as socioeconomic fields. The challenge is to build agroforestry education programmes that are adequately integrative and properly connected to existing disciplines and programmes.

This requires the development and review of existing institutions and curricula. Unfortunately, institutional inertia and traditional disciplinary boundaries can form formidable obstacles to such change. The authors hope the concepts and arguments presented here will help stimulate debate on this issue and encourage institutions to take on the challenge.

Landscapes are often dynamic patchworks, or 'mosaics', of crops, meadows, grassland, forest and agroforestry trees

Chapter 2. Global experiences in agroforestry education

Introduction

A review of past experiences is likely to be a useful starting point in any the curriculum development process. In this chapter we therefore briefly examine how academic institutions, primarily in Africa and Southeast Asia, approach agroforestry education. We also point to some common shortcomings of existing curricula. This is not a systematic analysis of curricula. Rather, it is an attempt to capture recent experiences in ANAFE and SEANAFE member institutions that can serve as suggestions for curriculum development and review. We follow this with a discussion of the job market for agroforesters, in an attempt to orient curricula towards the wide, and expanding, range of jobs available to graduates.

Agroforestry education: a brief history

Traditional forestry and agriculture teaching failed to notice that, in fact, a lot of farmers were mixing trees, crops and livestock in a lot of places – they practiced agroforestry. That omission began to be corrected in the 1970s, albeit slowly at first. The pace quickened as deforestation and land and soil degradation marked a decline in natural capital in many countries, and agroforestry came to be seen as a means of combining production with resource conservation.

Governments, donors, researchers, educators and NGOs joined forces to understand, develop, and promote various agroforestry systems. It was noted that agroforestry could contribute directly to food security, health and nutrition through improvement of land productivity and services. As a result, the number of educational institutions that provided **agroforestry education and training increased** very rapidly during the 1980s and 1990s. This trend seems likely to continue: in 2003 and 2004 alone, several international conferences tackled issues of agroforestry education.

That said, an opposite trend can also be seen at the technical (that is, certificate and diploma) level. Traditionally, many countries established

technical colleges under their ministry of forestry or agriculture, primarily to provide them with field staff. That link between education and employment is no longer as strong, partly a consequence of structural reform programmes that have reduced public sector employment. This is a main reason for the decline of technical education, especially in Africa. In consequence, fewer graduates with agroforestry competence are available at that level.

Growing international concern for the environment – articulated in Agenda 21 (United Nations 2004) and numerous other conventions and agreements on biodiversity, climate change, marine protection and desertification – spotlighted the potential contribution of agroforestry in environmental conservation. Meanwhile, the development paradigm has shifted from top-down research and extension towards bottom-up approaches that put the poor first, and which focus on sustainable livelihoods, local participation and development of local institutions. All this has shifted the perceived 'ownership' of innovations and decisions from experts to farmers. For example, small-scale farm businesses, often based on agroforestry tree products, were often previously overlooked. Our view of agroforestry is being revised accordingly. And these changes are now being seen in the context and focus of agroforestry education programmes.

Agroforestry education at different levels

Numerous universities and colleges offer **agroforestry degree programmes**. Most commonly, however, agroforestry is taught as a **core or elective subject**, or a **topic** within other, related subjects. While some institutions have separate agroforestry departments, faculties or institutes, the majority have put agroforestry education under the faculties of either forestry or agriculture.

To describe the context in which this guide may best be used, it is worth reviewing the four main levels of agroforestry education, namely technical (certificate and diploma) and professional (B.Sc. and postgraduate). For each, we will consider:

- How agroforestry is taught globally, with some specific examples.
- Typical jobs for agroforestry graduates.
- Which topics are usually covered and which are not.
- Recommendations for curriculum development and implementation.

Agroforestry at the technical level

Certificate-level training

Institutions in some countries include agroforestry content in **certificate** programmes, primarily in forestry and agriculture. Their durations vary from a few months to two years. Usually, agroforestry is offered as specific **subjects**, or as **topics** within other subjects. However, certificate-level training in many countries in Africa and Southeast Asia is now in decline (Temu and others 2005).

On graduation, certificate holders prove eligible for employment as frontline extension or development workers, technical assistants or, in some countries, teachers. That said, once-important government employment is declining in many countries.

Given the important role played by technicians and extension workers in natural resource planning and management, curricula at certificate level should be both broad and applied. In addition to principles and practices of agroforestry, curricula should include topics such as; the role of agroforestry in rural development; seed systems; socioeconomics, including gender in agroforestry; ecological aspects of agroforestry; agroforestry intervention approaches; extension methods (Lassoie 1990); marketing; and business management.

In particular cases, specific topics important for the country or region can be included, such as HIV/AIDS and agroforestry. The overall focus is clearly on practical skills to implement meaningful agroforestry interventions, and much emphasis should be put on agroforestry practicum.

Diploma-level training

Training at **diploma** level can vary in length from one year for in-service programmes to three years for regular diploma programmes, though with marked differences between countries. As with certificates, diplomas that include agroforestry are awarded by both agricultural and forestry institutions. Typically, agroforestry is taught as a separate **subject** within a diploma programme, such as the diploma in forestry taught in the Kenya or Zimbabwe Forestry Colleges, or the diploma in agriculture from Botswana Agricultural College. In some institutions, agroforestry is a **full diploma programme**, as with the post-graduate diploma in agroforestry from the University of the Philippines Los

Baños, or the diploma in agroforestry from Nyabyeya Forestry College, Uganda. Mbalmayo Forestry College in Cameroon offers both certificate and diploma programmes in agroforestry.

Though agroforestry curricula from different places and institutions will never be identical, some core topics should be standard for all diploma courses. Diploma graduates often play important roles as field technicians, extension workers or teachers, and their training should reflect this. For example, the agroforestry diploma at the University of the Philippines Los Baños includes appropriate on-farm technologies, cottage industry development in agroforestry, and community organization and development for agroforestry. These important topics are unfortunately often missing in diploma curricula. Another topic that should be considered is agroforestry monitoring and evaluation (Kung'u and Temu 2003).

Diploma graduates play a key role in sharing agroforestry knowledge with the ultimate users – the farmers. Graduates should thus be able to facilitate a process of shared learning, in participation with local communities, institutions and government units. This is a quite different approach to the 'technology transfer' paradigm that is still widely taught. Hastening the shift to greater participation is one motivation for encouraging review and development of curricula.

Agroforestry at the professional level

Bachelor's degrees in agroforestry

Agroforestry graduates with a **bachelor's** degree frequently work in research and in mid-level positions in the extension service. This type of training is offered under a bewildering array of programmes throughout the world.

Commonly, as with the University of Florida, USA, agroforestry is offered as a **subject** in a forestry bachelor's. In Uganda, agroforestry is offered as a subject in several different B.Sc. programmes, including forestry, community forestry and agriculture. Agroforestry may also be found as a subject within bachelor's degrees in animal science, environmental science and soil science. Degrees as varied as landscape architecture and home economics can sometimes feature agroforestry.

Yet more programmes include agroforestry as a **topic** within other subjects. This is probably more usual in institutions focussed primarily on agriculture.

More rarely, agroforestry is offered as a full undergraduate **programme** in its own right. The Philippines is a leading example. There, more than 30 universities and colleges, such as the Don Mariano Marcos State University, offer a bachelor's degree in agroforestry or a major in agroforestry. These programmes take three to four years.

Given this huge variation in undergraduate programmes, it comes as no surprise that agroforestry content differs widely. Topics like 'an introduction to agroforestry' and 'classification of agroforestry systems' are normally included in most curricula. Unfortunately, important topics − like the socioeconomic aspects of agroforestry, multipurpose trees and shrubs, agroforestry practices and technologies, the role of agroforestry in soil and water conservation, and research design and methodologies − are found in very few curricula (Kung'u and Temu 2003).

Other weak spots exist. For one, curricula should include topics that will enable the graduates to implement agroforestry projects, since it has been shown that many B.Sc. graduates will eventually become project managers or research scientists (Nair and others 1990). Topics such as marketing and entrepreneurship are also often omitted. Curricula are frequently oriented towards the supply side of agroforestry, such as the production of trees and shrubs. They thereby ignore the changing demand for products and services from those trees and shrubs.

More generally, given the fields of work adopted by many agroforestry graduates, there is a real need for transferable professional skills like proposal writing and communication. Where these are not covered in other course components, there is a strong argument for their inclusion in agroforestry, since good communication with agroforestry researchers, donor agencies, farmers and students will be essential in an agroforester's professional life.

Master's degrees in agroforestry

Agroforestry at **master's** level is relatively new, but already offered under all manner of different programmes. Most common is where agroforestry forms a component of another programme. For example, most universities offering master's programmes in forestry teach

agroforestry as a separate **subject**. In contrast, institutions in Africa offering master's programmes in agriculture or animal health normally include agroforestry as a **topic** within another subject (Kung'u and Temu 2003). One exception is Sokoine University of Agriculture, Tanzania, which offers agroforestry as a subject in agriculture, forestry and animal science M.Sc. programmes.

Combined courses also exist, such as at Kenya's Kenyatta University, which offers a combined master's programme in agroforestry and rural development. Agroforestry and sustainable development is offered in Universidad Autonoma Chapingo, Mexico.

Dedicated agroforestry **programmes** are available in some countries. Maejo University in Thailand, Kenyatta University in Kenya, Makerere University in Uganda and the University of Florida in the USA all offer postgraduate programmes in agroforestry. So do University of Malawi, Ibadan University in Nigeria, Sokoine University in Tanzania, University of Kwame Nkrumah in Ghana, Wageningen Agricultural University in the Netherlands, University College of North Wales in Bangor, UK, and Oregon State University in the USA. There are many others. In Southeast Asia, several universities are currently developing new master's programmes in agroforestry.

On top of taught programmes, students in a wide range of institutions and programmes carry out their master's **thesis research** in agroforestry or a related subject.

As with undergraduate programmes, the topics covered in master's programmes differ widely. Multipurpose trees and shrubs and agroforestry systems appear frequently. On the other hand, agroforestry research is taught in few institutions – an unfortunate omission, since many master's graduates go on to become researchers or lecturers. Research methods and skills are therefore priorities for postgraduate agroforestry curricula.

Further weak points exist where useful adjuncts to 'pure' agroforestry subjects are also left out. Biodiversity, which is important for understanding agroforestry's contribution to conservation, is taught in few programmes. Marketing and people-landscape interactions are other common omissions. Policy and governance processes, which include global and national environmental agreements and international commitments such as the Millennium Development Goals (United

Nations 2004), are clearly central to an understanding of agroforestry's larger role in development and conservation, but are also often overlooked. A last area that should legitimately be explored at postgraduate level is the complex issue of payments and other compensations to farmers for the provision of environmental services.

Across all levels of agroforestry education, teaching methods that encourage **life-long learning** need to be strengthened. It is also important to identify the current responsibilities and training needs of former graduates, and provide on-the-job training opportunities for them. The role of open and distance learning is here of particular interest.

Jobs in agroforestry

Agroforestry qualifications are in demand in a wide array of jobs, but can agroforestry provide a **career path** in the same way as agriculture or forestry? Can agroforestry develop as a distinct profession? These questions are debated among many stakeholders in agroforestry. In the early 1980s, policy documents did not specifically recognized agroforestry knowledge or skills. This has now changed in many countries. As a result, opportunities for agroforestry employment are emerging in national and local NGOs, educational and research institutions, development organizations, private sector companies, consulting firms and non-traditional employment. Yet graduates might find that a government career as an 'agroforester' is elusive, partly because agroforestry in most countries is not a 'certified' profession, like forestry or agriculture, and partly because of widespread downsizing in the public sector.

What other agroforestry jobs might be available? Self-employment in agroforestry is on the increase as many countries expand land allocation programmes, grant tenure rights to individuals, and liberalize the production and trade of agroforestry farming inputs, products and services. As the role of agroforestry in landscape management and the amelioration of environmental degradation becomes clearer, more job opportunities will open in these areas too. Ecotourism is a rapidly expanding sector in many countries, and can be a new niche for agroforestry graduates. Is this enough to expand professional education in agroforestry? There may be no single, universally accepted response, because it will depend on national choices and policies.

More generally, agroforestry is here to stay, and will continue to evolve. Given the emergence of agroforestry as a new field of employment, and occasionally a distinct profession, the challenge facing educational institutions is to monitor how traditional fields of employment change, and to capture emerging opportunities. Producing graduates that are demanded in the job market is the key to attracting new students. Thus the need to continually review curricula.

Education develops vocational skills and increases job opportunities for all

Chapter 3. Curriculum development principles and methods

Introduction

In this chapter we start by reflecting on how societies change, and how education must change in unison. One tool for changing education is, obviously, curriculum development. We therefore discuss that next, presenting four common approaches. The first three of these are the most widely practiced: top-down, faculty-initiated and faculty-controlled curriculum development. In our view, although these approaches have been used for many years, they may not result in the most applicable and result-focused curricula. Thus we also present a participatory approach to curriculum development that draws heavily on ANAFE's and SEANAFE's experiences, and which is built on approaches widely adopted in other fields of development.

Societal and educational change

A curriculum directs the process that prepares a learner for his or her role in society, normally in a specific disciplinary area. Curricula can thus be seen as one link between an educational institution or system and wider society (figure 3). The implication is that curricula must keep changing as society acquires new values or knowledge, as policies are revised and as new opportunities emerge. Reviews are essential for keeping curricula relevant, attractive and of the highest standards.

Ongoing development of old and new curricula is clearly desirable, but the method used is also important. To understand the process and benefits of different methods, it is helpful to distinguish between 'curriculum' and 'course content'. In this manual, 'curriculum' is used to describe the teaching and learning events that lead to a desired (and often explicit) competence, which is formulated according to a set of agreed standards. Curriculum development is therefore much more than a listing of course content, because it includes the entire process of planning, implementing and evaluating an educational programme. The quality of the final curriculum is based on our ability to describe the functions of programme graduates, and then to decide what knowledge, skills and attitudes are required to perform those functions effectively.

This chapter will outline the various approaches to developing curricula, specifically highlighting the strengths of the participatory approach described later in this guide.

How education influences society:
- graduates gain employment
- lecturers research, conduct outreach and participate in public debate

Educational Change

Changes related to the teaching and learning process, its tools and institutions:
- Institutional innovation
- curricula content
- teaching materials
- teaching and learning methods
- delivery capacity (human resources and learning facilities)

Societal Change

Local, national and long-term global trends:
- Poverty alleviation
- agriculture and rural development
- economic growth
- Demographic change
- environmental change
- global conventions, Millennium Development Goals and so on

How society influences education:
- research and development experience
- changes of policies
- changing financial and institutional arrangements, such as the autonomy of universities

Figure 3. Responding to and influencing change; a model of the dynamic interaction between society and education.

Methods for curriculum development

The curriculum is the backbone of any training or education programme. This is because it describes programme aims and objectives, content, teaching and learning methods, location, teaching materials and how outcomes are to be evaluated.

Curriculum development can be done in many ways, largely dependant upon national education policies, institutional practices and the experiences of key players. Methods for developing curricula therefore differ widely between educational systems, countries and regions. Naturally, curriculum developers need to observe national and institutional policies, and work within the financial resources available.

However, there is often enough flexibility to innovate, and thereby increase the quality and relevance of curricula. In some countries, such as Thailand and Indonesia, a trend towards increased autonomy in universities opens even more doors.

What we are most concerned with here are the great benefits in terms of quality and relevance achieved by involving stakeholders in the agroforestry curriculum development process (Temu and others 1995). Put simply, if stakeholders are involved in curricula development, training institutions and programmes become much more effective (Rogers and Taylor 1998).

But let's first consider the options. At a 1994 interregional workshop in Kenya, participants listed various methods use to develop environmental curricula (Rudebjer and Temu 1995). The inventory showed great variation in the way the curricula development process is initiated, organized and approved. Four main categories were identified, all of which we review below:

- top-down approach
- faculty-initiated approach
- faculty-controlled approach
- participatory approach

Top-down, or 'expert-centred', approach

In many English-speaking African countries, governments play a central role in initiating and managing the curriculum development process, particularly at the college level. Educational institutions are involved,

but in a secondary role. The curriculum is thus produced or reviewed with little or no consultation, and by an elite panel that mostly comprises educational 'experts' (Rogers and Taylor 1998). Much of the work is planned and implemented by the panel.

In this process, the panel finally produces a curriculum that is then presented to high ranking ministry officials. Once approval has been granted, the curriculum is passed to various institutions for implementation. This way, a national policy decision to incorporate agroforestry into, for instance, agriculture diplomas can be rapidly implemented in all institutions teaching agriculture. The factors that determine quality in this approach are how well national policy reflects real needs, and how effectively curriculum development captures the most recent and relevant knowledge.

Faculty-initiated approach

Colleges and universities in French-speaking Africa are more likely to use a curriculum development process lead by the faculty. The government's role is to approve the result, via a sub-regional academic body, CAMES (*Conseil Africain et Malgache pour l'Enseignement Supérieur*), of which sixteen francophone African countries are members. This body is responsible for, among other things, curricula reviews, accreditation and faculty promotions. Curriculum development in member countries is thus overseen by CAMES. The process is complex, but involves faculty at the concerned institutions, which initiate the process, with final approval granted by CAMES.

The strength of this method is the wide consultation that is possible, usually through questionnaires and workshops. However, the faculty-initiated approach slows the rate of change, since the process can be long and cumbersome.

Faculty-initiated approaches are also seen in universities in the Philippines, Indonesia and Thailand. Recently, however, universities in the latter two countries started gaining greater autonomy, and will soon be free to offer programmes without government approval. This type of deregulation should allow greater diversity in subjects and educational products, but may not necessarily lead to more participatory curriculum development.

Faculty-controlled approach

In Latin American universities, the whole process of initiating, considering and approving a new curriculum is largely controlled by the faculty. Private universities, operating outside the direct control of education ministries, often follow this process. Although differences exist, this faculty-controlled process has many similarities with the faculty-initiated approach favoured in Africa. It also contains many elements of the participatory model explained below.

Participatory approach

In the first three approaches described above, the 'clients' of the graduates – farmers – are given little or no opportunity to influence educational curricula. Likewise, there is no specific mechanism to consider what expertise from other disciplines could be used in curriculum production. In our view, a participatory approach to curriculum development has the greatest potential to address these shortcomings, and thereby accommodate better the complex needs of agroforestry education.

In the past decade, ANAFE and SEANAFE have facilitated the development of agroforestry curricula in over 85 universities and colleges. Both have slightly different methods for facilitating the participation of important stakeholders; ANAFE uses Developing A Curriculum, abbreviated to DACUM, while SEANAFE calls their process Participatory Curriculum Development (PCD). The overall philosophy of the two approaches is the same; stakeholders are best placed to define curriculum needs and develop learning objectives to meet them. In this chapter we present the basic elements of the DACUM and PCD approaches. Readers wishing to learn more should refer to the References at the end of this guide.

Once the decision to change or create a curriculum has been made, the participatory development process follows. There are five main components which if followed in order provide a framework for planning the individual activities and tasks involved in curriculum development (figure 4):

Activity	Leadership	Participants
1. Planning the curriculum development project • situation analysis and training needs assessments; analysis of demand for agroforestry knowledge and skills in job markets • resource requirements and mobilization • stakeholder analysis • plan the workshop process • identify and select participants • set the time table for the project	• depending on setting: for example, faculty leaders	• policy makers, such as ministries of education, forestry and agriculture • educators
2. Implementing workshop(s) • describe purpose and intended outputs to participants • agree on job opportunities that the curriculum will target • identify competencies (knowledge, skills, attitudes) demanded in the job market • set learning objectives	• workshop facilitator	• determined by the stakeholder analysis (activity 1)
3. Course development or planning • select content, methods, materials, time • prepare syllabi and sequencing of topics	• determined by the institution	• all stakeholders: mode of participation determined through consultation
4. Implementation of the curriculum • gain approval for the programme from the appropriate authority • organize human, financial and material resources • teach the course	• educators	• all stakeholders: mode of participation determined through consultation
5. Monitoring and evaluation • monitor the implementation and progress of the curriculum • evaluate relevance, effectiveness, efficiency and sustainability against the desired competencies	• educators (monitoring) • external expertise (evaluation)	• educators and students (monitoring) • all stakeholders (evaluation)

Figure 4. The main components of a participatory approach to curriculum development.
Source: adapted from Rogers and Taylor (1998) and Mancebo (1993)

Chapter 4. Agroforestry curriculum development

Introduction

How should agroforestry curriculum development be approached in practice? In this chapter, we again highlight the need to focus curricula on livelihoods and landscapes, and to consider the policy framework. Such 'situation analysis' describes the context of the programme. We then present a toolbox of seven 'requirements' – training needs analysis and stakeholder analysis among them – that the curriculum developer might find useful.

Bringing livelihoods, landscapes and policies into curricula

Developing curricula in agroforestry is more challenging than in more established traditional disciplines such as forestry or agriculture. One reason is the wide scope of agroforestry, which means developing agroforestry curricula requires **systems thinking and collaboration among disciplines**. A second reason is that agroforestry has no clear career path in most countries. Unconventional thinking may therefore be required regarding job opportunities, so that both existing land-use organizations and emerging job markets, such as the environment, are targeted. Curriculum developers need to take such things into account.

Three further characteristics of agroforestry add to its complexity as a discipline. Firstly, agroforestry is about the integrated management of crops, trees and livestock enterprises. Small-scale farmers have developed great knowledge and skills in these areas. The **livelihood strategies** of small-scale farmers are therefore an important starting point for agroforestry curricula development.

Secondly, the landscape in which the farmers live and work must be understood. Farming households obviously depend on the land, but they also shape the landscape with their decisions, among them the incorporation of trees into farming systems. These decisions may improve or reduce the effectiveness of the landscape's ecological functions and 'ecosystems services'. Therefore, **landscape** issues should be central to the curriculum.

Thirdly, farmers are heavily influenced by national and international policies and governance systems. For example, changes in land tenure systems are fundamentally changing farmers' land use options in many countries. Likewise, global environmental conventions and the Millennium Development Goals are just some of numerous international policies that impact on land use. **Policies and governance** must therefore also be considered in agroforestry curriculum development.

Seven suggested requirements for agroforestry curriculum development

As we saw in chapter 3, a curriculum is a logical sequence of learning experiences geared to develop specific competencies. Curricula guide teaching and learning, and curriculum development must focus on that from inception to implementation. Because each situation will be unique, different approaches will be suitable for each. But some general considerations will apply in most situations. Here we suggest seven requirements for successful curriculum development, regardless of the exact approach to be adopted:

1. *Analyse training needs*. Where is expertise in agroforestry needed? What type of expertise? How many people?
2. *Take account of development and environmental needs*. What are those needs? What contribution will the curriculum make to development or environmental management?
3. *Assess the institutional setting*. What adjustments to the curriculum development process are needed to suit the specific situation?
4. *Estimate the resource requirements*. What resources are necessary to develop and implement a good curriculum? Which are actually available?
5. *Focus on competencies to be developed*. What competencies need to be developed? Which competencies are already being provided by existing courses or programmes? Can desired competencies be achieved by modifying the content and/or delivery of existing subjects, or is a major curriculum revision required?
6. *Consider stakeholder participation*. Who should be involved in the curriculum development process? How?
7. *Capture the multidisciplinary opportunities*. What biophysical and socioeconomic issues will be addressed? Which disciplines need to be involved in curriculum development?

1. Analyse training needs

In developing countries, employment in agriculture or forestry has mostly been in the public sector. State employment can no longer be taken for granted, however. New competencies are therefore required to match new job opportunities – such as in 'the environment', or in the NGO or private sectors. Competency needs have to be constantly reassessed so courses can deliver the right sets of skills and knowledge. **Training needs analysis** (TNA) is one tool to help describe what the education programme is intended to achieve.

There is a wealth of literature on TNA, and institutions can chose which method best suits them. We find the approach suggested by Taylor (2003) to be both simple and effective. Taylor suggests training needs should be analysed at three levels: Firstly, the needs of the organizations where the trainees do or will work are identified. Secondly, a task or job analysis generates information on job components and the skills, knowledge and attitudes needed to perform them to a required standard. The gaps which can be filled by training are determined and prioritized. Thirdly, individual training needs are assessed whenever possible, such as via self-assessment questionnaires or interviews.

In practice, Taylor suggests approaching a TNA as a participatory research process, where, again, the methods chosen depend on the situation. Participatory tools such as mapping, ranking and transect walks can be used. As in all research, careful planning of key questions, methodology and logistics is required.

The planning of the **organizational analysis** would list organizations with a stake in the training. Key questions are then listed, to trace, for example, critical changes, strengths and weaknesses, or opportunities and threats (see figure 5).

Organization	Questions	Source of information	Method of collection	Responsibility
Forestry extension service	What are the critical changes affecting the work of the organization? What are the organization's strengths and weaknesses?	Ministry of Forestry; Province forestry extension officers	Questionnaire; Semi-structured interviews	TNA team

Figure 5. Example planning matrix for an organizational analysis.
Source: Adapted from Taylor (2003)

In planning the **job and task analysis**, the frequency, importance and learning difficulty of each task can be tabulated (figure 6). Once the table is completed, the tasks are prioritized. Tasks with high priority can then be subject to further analysis of the knowledge, skills and attitudes required for someone to perform them.

Task	Frequency	Importance	Learning difficulty	Priority
(e.g. conduct participatory land use mapping in villages)	1. Seldom 2. Occasionally 3. Weekly to monthly 4. Daily to weekly 5. Daily	1. Little importance 2. Moderate importance 3. Very important	1. Easy 2. Moderately difficult 3. Difficult 4. Very difficult	1. Low 2. Medium 3. High

Figure 6. Table for job and task analysis.
Source: Adapted from Taylor (2003)

Once the tools are developed, data collection follows, usually through interviews or questionnaires, or a combination of the two. Good interviewing skills are important to accurately and objectively capture the informants' views.

Consideration of the TNA results for the organizations, tasks and individuals follows, to identify patterns of issues and needs. Some of the issues that emerge cannot be dealt with through training. They can therefore be ignored during curriculum development, though they may need to be addressed in other ways. Other issues will be more relevant to training, and can be re-phrased as sets of knowledge, skills and attitudes that the programme aims to develop. These then form the core of the curriculum.

Not all needs are easily captured via a TNA, however. Consider research. Recent agroforestry research outputs are unlikely to be well known outside academia. If the respondent of a TNA is unaware of that field of research, he or she would not be able to indicate the need for better knowledge or skills in that particular area. This why a broader situation analysis is needed in conjunction with the TNA.

What knowledge, skills and attitudes are required to capture farmers' insights in tree domestication?

2. Take account of development and environmental needs

Few countries have specific agroforestry policies. But many now recognize that agroforestry can play an important role in their rural development and environmental programmes. Analysing the relevant needs and opportunities, and incorporating them in agroforestry curricula, helps ensure the discipline remains relevant.

Agroforestry innovations clearly respond to **rural development needs and policies**. In the face of deforestation and growing demand for timber and non-timber forest products, agroforestry trees are increasingly important. And as more and more trees are planted on farms, there is an increasing need for joint planning of agricultural and forestry programmes. Furthermore, new agroforestry options are adding substantial value to traditional farming systems. Keeping new courses up to date with this evolving relationship between development and agroforestry is essential.

Agroforestry's environmental role also needs constant reflection. Primarily, this is because agroforestry can make a major contribution to rehabilitating agricultural landscapes. International commitments on biodiversity, climate change or desertification cannot all be met through the designation of conservation areas. Thus, managed agro-ecosystems with trees incorporated in farming systems – mosaic agroforestry landscapes – are seen as practical alternatives. Agroforestry education needs to reflect the contribution agroforestry can make to achieving new environmental goals, including biodiversity conservation, watershed regulation, carbon sequestration and aesthetics.

Numerous international environmental agreements and conventions have taken effect in recent years. Most countries have signed them, and are busy integrating them into national policies for poverty alleviation and environmental conservation. Many of these agreements have direct implications for agroforestry, such as several of the Millennium Development Goals (figure 7). In practical terms, the curriculum development should therefore include a review of current policies, national and international, and their implementation.

Goal 1. Eradicate extreme poverty
- Target 1. Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day.
- Target 2. Halve, between 1990 and 2015, the proportion of people who suffer from hunger.

Goal 3. Promote gender equality and empower women
- Target 4. Eliminate gender disparity in primary and secondary education, preferably by 2005, and to all levels of education no later than 2015.

Goal 7. Ensure environmental sustainability
- Target 9. Integrate the principles of sustainable development into country policies and programmes and reverse the losses of environmental resources.

(United Nations 2004)

Figure 7. Millennium development goals with a bearing on agroforestry.

3. Assess the institutional setting

Each institution has it's unique **internal environment**. Institutional needs, human resources, facilities, financial resources and so on vary greatly between academic institutions. It is important to consider internal strengths and weaknesses regarding curriculum development; for example, the availability (or absence) of faculty members experienced in participatory curriculum development, or the institution's links with local communities.

Each institution also operates in a unique **external environment**. Student enrolment and graduate employment patterns differ even between universities in the same country. The policy environment may pose constraints on curriculum content, or present new opportunities, so explicitly considering it or involving policy makers is useful.

Due to external factors, there can be no 'one-size-fits-all' agroforestry curriculum, or even standard curriculum development process. Instead, flexibility is needed to be able to respond to the many internal and external opportunities and constraints on curriculum development.

4. Estimate the resource requirements

Curriculum development must adjust to financial realities and the availability of other **resources**, especially people. Money will certainly constrain aspects of curriculum development, such as the number of consultations that is possible. A pragmatic process that matches the method with these realities is called for. However, curricula are strategic instruments, and investing time and money in a good curriculum development process is important, both in terms of the learning outcomes, and to attract students to the programme in the first place.

5. Focus on competencies to be developed

The TNA identified the knowledge, skills and attitudes required to perform certain jobs. The situation analysis took account of research and innovations regarding livelihoods, landscapes and policies. Taken together, these results provide a list of competences required by society, and which the training or education programme must then strive to develop in students.

Competence is applied knowledge, and curricula must therefore match information with the skills to use it. It is far too common for curricula to

focus on delivering knowledge rather that imparting the skills and attitudes required to turn knowledge into practical use. In developing curricula, it may be therefore be useful to consult the literature on adult learning to ensure that the teaching and learning events chosen will actually result in the desired competencies.

A 'competencies approach' requires, among other things, sufficient practical learning events in the field and opportunities for students to develop and use analytical tools. 'Experiential learning' should be considered, where reflection on students' own experiences is part of the teaching and learning process. Also to be considered is the concept of 'life-long learning', because the ability to continuously seek knowledge is becoming increasingly important in fast-changing societies. Curricula can achieve this by developing learning skills that students can apply throughout their professional lives.

For longer education programmes, especially at post-graduate level, strategic competencies – such as project management, research planning and policy analysis – should be a focus.

6. Consider stakeholder participation

Put simply, **'stakeholders'** are the groups or individuals that have an interest or 'stake' in the curriculum. Deciding who are the most important stakeholders is perhaps just as critical as getting their input. Some sort of priority setting is required to determine which 'insider' and 'outsider' stakeholders should be involved, and in what way. Even non-participatory curriculum development situations can still benefit from identifying stakeholders and allowing some input. In particular, farmers and farmer groups need to be heard, because they are the ultimate beneficiaries of natural resources education. A well-conducted TNA is one example of how stakeholders can be involved, but their participation is important in other steps of the process too.

Key questions that arise are:

- Who are the stakeholders in the planned education or training program?
- What are their different interests and roles?
- How can they contribute to curriculum development, given the time and resources available?

A stakeholder analysis, conducted at the beginning of the curriculum development process, can help answer these questions. A very simple version is provided below (adapted from Rogers and Taylor 1998):

a) List the names of stakeholders. This can be done in groups, brainstorming who the stakeholders are and listing them on cards. The interest of each stakeholder with regard to the education programme is then elaborated (figure 8).

Stakeholder	Interest in the agroforestry program
e.g. Environmental NGOs	e.g. Projected need to employ 50 field technicians in the next five years
e.g. Farmers' organizations	e.g. Farmers would like to expand their agroforestry practices using high-value timber trees

Figure 8. Examples of stakeholder identification.

b) Complete an 'importance and influence' matrix (figure 9). To achieve results quickly, draw the matrix on a large sheet of paper, then write the names of the stakeholders on cards. Move one card at a time around in the matrix until the group agrees on where it fits best. Stick it there and repeat for all cards until all stakeholders have been classified.

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

Figure 9. Stakeholder importance and influence matrix.

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

Influence. Is the power a stakeholder has over the curriculum development or implementation processes. It is also the extent to

which people, groups or organizations are capable of choosing directions for others to follow.

The importance-influence matrix can be analysed as follows:

A. *High importance, low influence.* This group will require special initiatives to take their interests into account. Farmers usually show up in this category.
B. *High importance and high influence.* A good working relationship must be created with this group.
C. *Low influence and low importance.* This group may have some limited involvement in evaluation but is of relatively low priority.
D. *High influence but low importance.* This group may be a source of risk, and will need careful monitoring and management.

c)   Determine the type of participation that is required of each stakeholder. A matrix can be used, as in figure 10. This example is based on PCD methodology, but can be easily adapted to other participatory methods, such as DACUM (see chapter 3).

Stage in the curriculum development process	Role played by the stakeholders			
	Be informed	Be consulted: influence content and learning process	Be a direct partner	Provide supervision and quality control
Planning the process and participation				
Implementing the workshop				
Course development and planning				
Implementation of the education program				
Monitoring and evaluation				

Figure 10. Stakeholder participation matrix.
Source: Adapted from Rogers and Taylor (1998)

When completing the matrix, availability of time and money need to be considered. Thus the matrix is not the 'ideal' situation but the most achievable, and the desired intensity of stakeholder involvement needs to be adjusted to the actual curriculum development situation (Rudebjer and others 2001).

7. Capture the multidisciplinary opportunities

As we discussed in chapter 1, a central feature of agroforestry is that it embraces a wide range of natural and social sciences. This influences curriculum development in at least two ways. Firstly, existing programmes such as forestry, agriculture, animal husbandry, social science and economics may already teach content that is important to the learning outcomes of the agroforestry curriculum. In such situations, inefficient overlaps can be avoided by looking for opportunities for collaboration and synergy. Shared subjects and team teaching by lecturers from several faculties are the most obvious solutions. For example, involving the faculty of economics in teaching a course on livelihoods analysis would help students understand how markets influence farmers.

In other cases, such as in small colleges, expertise in relevant disciplines may not be available. For example, socioeconomics is often a weak spot in natural resources education. Collaborating with the local extension service or inviting expertise from other academic institutions may bridge these gaps.

Multidisciplinary collaboration between faculties and departments that are administratively separate may pose a challenge. Special consideration therefore needs to be given to the costs and benefit involved, such as the expense of hiring external lecturers, or the effort required to encourage networking.

Sustainability of fuelwood production is a primary concern among many agroforestry stakeholders

Chapter 5. A framework for agroforestry curricula

Introduction

We previously discussed how agroforestry has evolved as a science. We also reviewed how agroforestry is taught, and identified some common gaps in curricula. Furthermore, we reviewed methods for curriculum development and suggested how academic institutions can approach the development process. In this concluding chapter we present a **framework for agroforestry curricula**. Obviously, each institution will use the framework according to its own situation analysis and education objectives. The level of education and the time allotted to agroforestry content will also define how the framework is used. Our framework is therefore a tool rather than a recipe.

The agroforestry production cycle

Understanding how farmers decide whether or not to incorporate trees and shrubs into their farming systems is an important part of agroforestry research and development. Thus, it is also important to agroforestry learning. Here, we use a simplified model of the agroforestry production cycle (figure 11) to highlight the complex and dynamic process of farmers' strategic planning, decision-making and reflection.

Fast cash; high value trees in the backyard

PLANNING AND DECISION MAKING

c) DECISIONS ON USE OF PRODUCTS AND SERVICES

Subsistence consumption

Value-adding post-harvest processing

Marketing of agroforestry tree products and services

Reflection on experience

a) DECISIONS ON AGROFORESTRY PRACTICES

Choice and propagation of genetic materials of agroforestry trees and shrubs, crops and animals

Arrangement in space and time of tree-crop-animal combinations

Management to achieve optimal systems potential

b) OUTPUTS OF AGROFORESTRY PRACTICES

Services
Carbon storage, biodiversity, landscape beauty, erosion control, windbreaks and so on.

Products
Timber, fuelwood, food, fodder, fibers, medicines and so on.

Figure 11. A model of farmers' agroforestry production cycle.

One thing to note is that the process is cyclic, and thus able to evolve through various repetitions. Another key feature is the enormous amount of knowledge and experience required, which has to be deployed within the particular social, cultural and economic setting.

Farmers often manage several 'agroforestry cycles' in parallel. They differ in the tree-crop-animal combinations used, and in spatial and temporal arrangements. The age of each will also likely differ, and landscape characteristics may be highly variable. In any one system, not

all agroforestry species necessarily complete the cycle. For example, the use or uses of a particular species may be changed during the cycle, it may be terminated by the farmer, or it may simply die. This underscores the complexity of decisions that farmers face almost every day.

'Traditional' agroforestry curricula focus on agroforestry technologies and how they may be disseminated via extension. Classification of agroforestry systems is also given ample consideration. Other common topics include the plot-level interaction between various tree, crop and animal combinations, especially competition for water, nutrients and light. Seedling production appears frequently.

These topics are still valid, but there is often no accompanying discussion of the **decision-making processes** associated with the choice, arrangement and management of agroforestry trees (figure 11, box a). Failure to consider the choices farmers make has resulted in promotion of agroforestry technologies that farmers found expensive or impractical. One example is alley cropping, where competition between hedgerows and crops combined with high labour requirements lead many farmers to abandon the technique. In other cases, farmers modified or adapted the technique to match their preferences. In contrast, farmers frequently show great interest in fruit trees, which are often low-input, more easily incorporated into existing farming systems, and provide both food and cash income.

Agroforestry practices result in a range of wood and non-wood products while also providing services such as improved soil or wind protection (figure 11, box b). Naturally, these **products and services** drive a farmer's interest in agroforestry. But many agroforestry services – biodiversity conservation or carbon sequestration for example – primarily benefit external stakeholders. Farmers are rarely paid or otherwise compensated for providing these benefits. Research into payments for environmental services has recently attracted much attention, and is an area where interest and knowledge is fast expanding.

Agroforestry is often perceived as a means of reducing poverty while enhancing the environment. For this reason, poor farmers are targeted for the introduction of assorted agroforestry 'models' or technologies. The imbalance of power means that without determined effort, agroforestry extension is often supply driven. This is frequently also the

case in agroforestry education. Yet farmers are in some ways operating small-scale businesses; marketing and value adding can therefore be critical to them. Agroforestry programmes need to recognize this aspect of farming and strengthen the **demand side** of agroforestry learning to include marketing and value-adding activities, such as microenterprise development (figure 11, box c).

Putting farmers first is an important part of agroforestry curriculum development

External influence and impacts

We will now broaden our model of the agroforestry production cycle to include external influences, and impacts on livelihoods and landscapes. Thus in figure 12 we illustrate how farmers' everyday actions are influenced by various biophysical, social, cultural and economic conditions, and by policies and governance.

Biophysical conditions may be favourable, such as good rainfall patterns, or unfavourable, such as poor soils.

Socioeconomic conditions such as labour availability, health issues, access to capital and so on, will affect day-to-day decisions. Farmers are also influenced by a range of laws and government policies, including land tenure and environmental regulations. Governmental and non-government bodies may also influence farmers, such as through the presence of agricultural or health extension.

Agroforestry can clearly have positive impacts on peoples' livelihoods and on the sustainability of landscapes. But there are potential negative

impacts, or challenges, too. For instance, a new tree or shrub species could become a pest, or attract undesirable pests and diseases. And impacts that farmers regard as positive may be negative for outside stakeholders, or vice versa. It is therefore important to analyse risks and trade-offs before developing or promoting particular agroforestry models. Decisions can then be made on the overall net result, and efforts made to maximize it. This raises the issue of scales, as we discussed in chapter 1, because the impacts of agroforestry practices are often beyond the control of an individual farmer.

An agroforestry curriculum should cover all these aspects. We now look in more detail at how our expanded agroforestry production model can be used as the basis for developing education programmes.
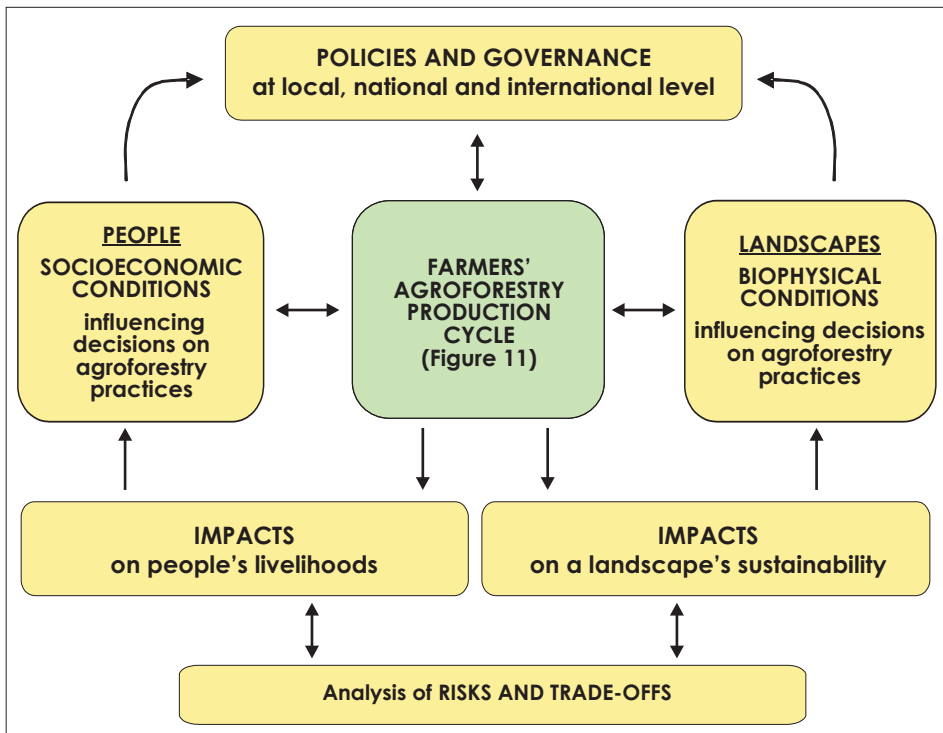

Figure 12. External influences on farmers' decisions, and the impacts of those decisions on people and landscapes.

The curriculum content

In the following section we expand each part of the model in figure 12. Step by step, we identify a range of generic elements that can be incorporated into an agroforestry curriculum. The specific content will of course vary between institutions and courses. Our list is therefore not prescriptive, but it should be a useful starting point for discussions on what should and should not be included. The complete agroforestry curriculum framework is also presented in Annex 1.

The aim is to put **farmers in the centre** of the agroforestry curriculum, as opposed to leaving them as a target for outside interventions. **Risks and trade-offs** are highlighted as important considerations in a practical understanding of agroforestry. We also emphasize the need to consider **wider processes** related to impacts, policies and governance.

Biophysical conditions

Box 1. Biophysical conditions that influence agroforestry
- geology and soils
- climate (temperature, rain, wind)
- topography
- water flow and quality
- farm size and shape
- position of farm in the landscape (e.g. proximity to forest)
- distance to markets

A range of biophysical conditions influence a farmer's decision to establish, change or discontinue various agroforestry practices (box 1). These conditions relate to soils, climate and the geographic location of farms. For example, soil fertility, access to water and water quality are important considerations. Distance to markets will influence what type of crops a farmer grows.

Biophysical conditions also relate to how a farmer perceives **risks**. Is the farmer willing to take risks, such as introducing an unfamiliar agroforestry system? Or does he or she prefer to stick to old and proven practices? Some farmers can be more willing to take risks than others – a fact to consider when analysing decision making among farmers. Many of these biophysical issues are likely taught in other subjects, but their importance in the context of agroforestry decisions may suggest further emphasis is needed.

Socioeconomic conditions

Socioeconomic conditions will also need consideration (box 2). A livelihood analysis can be a good way of understanding the complex

interactions that influence agroforestry practice.

'Livelihood' can be described as all the different elements that contribute to, or affect, peoples' ability to ensure a living for themselves and their household. These elements include assets, activities, outside factors that affect vulnerability, and policies and institutions.

One tool for livelihood analysis is 'Local institutions and livelihoods: guidelines for analysis' (Messer and Townsley 2003). This toolkit includes modules on conducting a community profile, understanding household livelihood strategies, understanding local institutions and analysing and understanding linkages, among others.

> **Box 2. Socioeconomic conditions that influence agroforestry**
> - demand for products and services
> - market access and information
> - infrastructure (roads, irrigation and so on)
> - access to capital and credit
> - off-farm alternatives
> - land and tree tenure, restrictions to access (such as in protected areas)
> - policies, incentives and restrictions
> - germplasm access
> - knowledge, awareness and extension
> - communication and knowledge management
> - household composition and risk aversion
> - labour, health, HIV/AIDS
> - gender issues
> - local institutions
> - social conflicts

Socioeconomic factors include markets, infrastructure, off-farm alternatives and availability of credit. Household-to-household variations are also important, including availability of labour and willingness to take risks. Men and women have widely different household roles, as do different generations in a family. Access to information depends on educational level, and mostly relies on agricultural extension and the media. Health issues are very important, including the impact of HIV/AIDS on household labour and healthcare expenses. In this context, agroforestry products can provide a more nutritious diet or be a source of traditional medicine. Such considerations underscore the close relationship between agroforestry and rural development as a whole.

Impacts of agroforestry practices on landscape sustainability

The impacts of agroforestry practices on landscape sustainability are shown in box 3. They may be positive or negative, or both. Some impacts are local, such as where trees reduce soil erosion, fix nitrogen or

cycle nutrients from deeper levels. Other impacts are more widely felt, such as carbon sequestration or biodiversity conservation. Although these conditions appear difficult to analyse from a teaching perspective, tree cover, water dynamics, wind breaking effects, surface temperature and carbon sequestration are fairly easy to measure. Simple tools for participatory monitoring of water quality are now available, for example.

> **Box 3. Impacts on landscape sustainability**
> - soil conservation and fertility: physical, chemical and biological properties
> - improved landscape functions: water and nutrient cycling, above- and below-ground biodiversity, watershed functions, carbon storage, landscape aesthetics, micro-climate, wind speeds
> - multifunctional landscape mosaics

Off-farm impacts are significant, so should not be ignored. Farming landscapes consist of a number of different agroecosystems. The combined efforts of many farmers define the overall productivity and environmental services of that landscape mosaic. Understanding the ecological functions at different scales – plot, farm, watershed and region is a key to balancing the local and external benefits of agroforestry.

Impact on livelihoods

Agroforestry practices **impact on livelihoods** in a many ways (box 4). Students of agroforestry need to know how agroforestry tree products can reduce vulnerability or enhance the income and wellbeing of rural households. The starting point is understanding farmers'

> **Box 4. Impacts on livelihoods**
> - food security
> - cash income and market access
> - health and nutrition
> - risk reduction/aversion
> - wood security: poles, firewood, fibres and so on
> - animal health and productivity
> - labour savings
> - environmental service compensations

livelihoods and how agroforestry addresses livelihood constraints. This is best achieved with field training, through village case studies and other such methods. It is also essential that students appreciate that agroforestry is only one of a range of tools required to reduce poverty.

Risks and trade-offs

While agroforestry provides numerous options for improving landscapes and livelihoods, it is also important to analyse **risks and trade-offs**. Crosscutting issues (box 5) are normally beyond the control of an individual farmer, but are important for the success of global efforts in agroforestry.

> **Box 5. Risks and trade-offs**
> - ecological risks: invasive species, allelopathy, pests and diseases
> - trade-offs: a) long rotation leading to postponed return on investment, b) balancing on-site benefits with off-site impacts
> - competitiveness of agroforestry systems versus monocultures
> - managing landscape mosaics which keep changing as a result of decisions by many individuals

One example is the global Alternatives to Slash-and-Burn programme (see Internet resources at the end of this guide), the aim of which was to analyse trade-offs between local, regional and global benefits of tropical land use systems. Other costs and benefits also need to be considered, not least because there is always an opportunity cost to interventions; resources spent on agroforestry in one place are resources not spent on microcredit or health extension, or in another place. The ability to look for the underlying forces driving land use change, to negotiate land use conflicts and even to assess whether agroforestry is the best solution to a particular problem is essential for client-oriented agroforestry education.

Policies and governance

Finally, policies and governance at all levels – international, national and local – influence agroforestry practice (box 6). Some national policies are clearly supportive of agroforestry, but others may pose obstacles. Examples of the latter are numerous, and include regulations on the harvesting and transport of timber, or development priorities that result in internal migration, such as the construction of dams. International policies are also relevant; conservation conventions and agreements, for example, oblige national governments to increase the land area designated for nature conservation, greatly affecting livelihood options for farmers in and around protected areas.

Other governance issues which may impact on agroforestry practices include land grabbing, conflicts with agro-industry and corruption. A pragmatic look at the political economy of development would be a

useful component of any agroforestry course.

In some cases policy changes are rapid and fundamental, such as the imposition of a logging ban or the granting of land tenure to farmers. And a wide range of organizations and bodies are involved in natural resource governance, including local government, extension services, NGOs, farmer organizations and, obviously, academic and training institutions. Understanding this 'institutional framework' is crucial to the effective promotion and scaling-up of agroforestry innovations.

> **Box 6. Policies and governance**
> - macro policy and institutional arrangements impacting on agroforestry practices
> - international processes and agreements: Millennium Development Goals, the UN Convention to Combat Desertification, Convention on Biological Diversity, Agenda 21, Kyoto Protocol.
> - interinstitutional and interdisciplinary issues: who is responsible for agroforestry?
> - adoption, adaptation and scaling up
> - other governance aspects, including land grabbing and conflicts, corruption, and so on

Presenting and implementing a curriculum

Assuming the approach in this guide is followed, curriculum development will consider the complete agroforestry curriculum framework (Annex 1) in the light of a TNA, an overall situation analysis and the specific educational objectives of the institution. Modifications are inevitable and desirable; some items will be added, while others omitted because they are already taught, or because educational objectives call for a different focus. This process will result in a list of topics for a subject or programme, but the detailed planning of the curriculum remains.

As we have seen, the range of methods for developing curricula is diverse, and it is beyond the scope of this guide to go into more detail. We therefore refer readers to the wide body of literature on this subject (see the References and Internet resources sections at the end of this guide). The literature will also advise on teaching and learning processes, adult learning, resource requirements and performance evaluation.

There are, however, some considerations specific to developing agroforestry curricula. These we briefly discuss now.

Presenting the curriculum

Firstly, agroforestry curricula are best presented in the context of the human development goals that agroforestry aims to meet. The introduction to the curriculum should show how the learning of agroforestry can contribute to the development goals of society, such as poverty alleviation, food security and environmental amelioration. This puts the agroforestry programme or subject into a wider perspective.

Secondly, the links between agroforestry and other subjects, such as agriculture, forestry and natural resources management, should be demonstrated. Agroforestry curricula should emphasize systems thinking and a multidisciplinary approach, This will enable the learner to understand how agroforestry contributes to sustainable livelihoods and landscapes.

Thirdly, curriculum topics and subjects should be organized in a logical sequence. An example of a sequencing procedure is described by Kasolo and Temu (1995), who suggest that the identified topics are listed and each given a unique code. A matrix is then developed, in which the relations between topics are marked. The question to ask is, 'Does topic A need any pre-knowledge of topic B?' Some topics will depend heavily on knowledge of others, while some will not.

The actual teaching order should start with topics that require the least knowledge of other topics. The course then progresses to those topics that require increasing levels of prior knowledge. Content sequencing should also consider seasonal activities, such as patterns of cropping and livestock managements. The topics to be included in a subject may then be presented as in figure 13.

Fourthly, the curriculum should state clearly what knowledge, skills and attitudes can be expected from it, and what the expected teaching and learning outcomes of each subject and topic are. Figure 13 also includes space to identify these outcomes, which should be made clear to the learners themselves. This approach means the curriculum will have realistic and achievable goals, against which its success can be measured. It will also help keep the course more applied and less

academic, because focussing on learning outcomes will ensure some wider societal need is being met.

Finally, one common challenge with curricula reviews is to avoid overloading with subject matter, since the adding of extra material can 'clutter' the curriculum. The possibility for integration with subjects such as extension, soil and water conservation or rural development should therefore assessed.

Subject	Learning outcomes (on completion, the student will be able to...)	Topics	Contact hours	Remarks
Agricultural solutions to HIV/AIDS problems	• Analyse and select farming innovations that are least labour intensive. • Advise farmers on productivity improvement techniques. • Put together packages of innovations that can improve nutrition and health security for farmers.	• The challenges to living with HIV/AIDS. • Incorporating HIV/AIDS messages in agricultural extension. • Soil enriching trees and shrubs. • Crops rich in vitamins and minerals. • High value trees and shrubs. • Medicinal plants and products. • Labour saving techniques, such as zero tillage systems.	Theory 20 hours Practicum 20 hours	Intensive discussions will be needed on agroforestry solutions available to farmers in different agro-ecological conditions. Processing and marketing possibilities should be discussed. Examples of products must be available.

Figure 13. Identifying topics and learning objectives for a subject.

Implementation of the curriculum

Agroforestry is multidisciplinary, and best taught in a collaborative manner by lecturers from biological and social sciences. In an institution teaching agroforestry, several departments or faculties are normally involved. These 'stakeholder departments' should be identified as a first step in curriculum development, after which one is selected to host the programme.

Once course content has been elaborated, teaching should then be assigned to separate departments, with lecture notes shared by all staff. To maintain quality and focus, team teaching may sometimes be the best option. Practicum classes too may be run jointly.

Learning agroforestry requires field practice with good exposure to environments where social and biophysical systems can both be examined. A good programme will therefore seek to encourage interactive learning with a number of different groups of farmers. The curriculum should include a sufficient amount of time for students to learn with communities. Experiential learning encourages students to appreciate the many challenges involved in agroforestry promotion.

Of course, costs need to be considered. In a practical subject like agroforestry, implementing a curriculum may be relatively expensive due to the amount of travel and field work needed. The latter could be one of the most costly aspects of the programme. Transportation, field gear and a wide range of measuring instruments are needed for field work. Involving a large number of disciplines may also be costly, because outside expertise, such as guest lecturers, may be required. All these costs must be included in the implementation budget.

Performance monitoring and evaluation

Agroforestry programmes require particular attention to monitoring and evaluation due to the rate at which the subject changes. As an important aspect of education management, monitoring should be done on a regular basis. Fortunately, there are a number of standard tools for measuring curriculum performance (see the References and Internet resources sections).

Although curricula are designed to run for several years, it is normally good to evaluate them after two to three student intakes. In general, performance is assessed in four key areas (known by the mnemonic REES) (Temu 2003):

- *Relevance* is the ability of the curriculum to meet the needs of farmers.
- *Effectiveness* is how well the objectives were met.
- *Efficiency* is a comparison of results and costs.
- *Sustainability* is demonstrated by reliable long-term effects and impact.

It is important that agroforestry education is monitored along with education in related disciplines, especially agriculture, forestry and livestock sciences, but also related subjects such as environmental science. A change in any of these programmes is likely to have impact on the content of agroforestry.

Conclusion

Quite deliberately, this guide does not provide a ready made structure or list of content for an agroforestry curriculum. A prescriptive approach is not justified because agroforestry programmes in universities and colleges vary so much, the settings in which agroforestry is practiced are so diverse, and our knowledge of the subject is continually expanding. Instead, we hope that this guide will stimulate discussion in academia about how to teach effectively the multifaceted subject of agroforestry. By advocating putting farmers' decision making in the centre of agroforestry curricula, we want to encourage agroforesters to explore how that process influences rural livelihoods and the environment on which we all depend. Agroforestry should then be better able to contribute to more equitable and sustainable rural land use. That, to us, is its aim.

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Internet resources

Many universities, research centres, government agencies and NGO's provide agroforestry related information on the Internet. An even larger number of sites are available on education and curriculum development. Here we list key sites, that often include free online libraries and links to related organizations.

Agroforestry and natural resources management

World Agroforestry Centre: www.worldagroforestry.org

Agroforestry Net: www.agroforestry.net

Alternatives to Slash-And-Burn Programme: www.asb.cgiar.org

Cabi Publishing (Agroforestry Abstracts): www.cabi-publishing.org

Food and Agriculture Organization of the United Nations; Forestry Department: www.fao.org/forestry/index.jsp

Integrated Natural Resources Management: www.inrm.cgiar.org

Millennium Development Goals: www.developmentgoals.org

Millennium Ecosystems Assessment: www.millenniumassessment.org

World Resources Institute: www.wri.org

Education

Eldis: The gateway to development information; education: www.eldis.org/education/index.htm

Institute of Development Studies; Participation Group: www.ids.ac.uk/ids/particip/index.html

International Institute for Environment and Development; Participatory Learning and Action: www.iied.org/sarl/pla_notes/index.html

Sustainability, Education and the Management of Change in the Tropics: www.changetropics.org/index.html

United National Educational, Scientific and Cultural Organization (UNESCO); education: www.unesco.org/education

Annex 1. Agroforestry curriculum framework

POLICIES AND GOVERNANCE AT LOCAL, NATIONAL AND INTERNATIONAL LEVELS

- macro policy and institutional arrangements impacting on agroforestry practices
- international processes and agreements: Millennium Development Goals, the UN Convention to Combat Desertification, Convention on Biological Diversity, Agenda 21, Kyoto Protocol.
- interinstitutional and interdisciplinary issues: who is responsible for agroforestry?
- adoption, adaptation and scaling up
- other governance aspects, including land grabbing and conflicts, corruption and so on

LANDSCAPES:
BIOPHYSICAL CONDITIONS INFLUENCING DECISIONS ON AGROFORESTRY PRACTICES

- geology and soils
- climate (temperature, rain, wind)
- topography
- water flow and quality
- farm size and shape
- position of farm in the landscape (e.g. proximity to forest)
- distance to markets

FARMERS' AGROFORESTRY PRODUCTION CYCLE

a) Decisions on agroforestry practices:
  - Choice and propagation of genetic materials of agroforestry trees and shrubs, crops and animals
  - arrangement in space and time of tree-crop-animal combinations
  - management to achieve optimal systems potential

b) Outputs of agroforestry practices:
  - services: carbon storage, biodiversity, landscape beauty, erosion control, windbreaks and so on.
  - products: timber, fuelwood, food, fodder, fibers, medicines and so on.

c) Decisions on use of products and services
  - subsistence consumption
  - value adding post-harvest processing
  - marketing of agroforestry tree products and services

PEOPLE:
SOCIOECONOMIC CONDITIONS INFLUENCING DECISIONS ON AGROFORESTRY PRACTICES

- demand for products and services
- market access and information
- Infrastructure (roads, irrigation and so on)
- access to capital and credit
- off-farm alternatives
- land and tree tenure, restrictions to access (such as in protected areas)
- policies, incentives and restrictions
- germplasm access
- knowledge, awareness and extension
- communication and knowledge management
- household composition and risk aversion
- labour, health, hiv/aids
- gender issues
- Local institutions

IMPACTS ON LANDSCAPE SUSTAINABILITY

- soil conservation and fertility: physical, chemical and biological properties
- improved landscape functions: water and nutrient cycling, above- and below-ground biodiversity, watershed functions, carbon storage, landscape aesthetics, micro-climate, wind speeds
- multifunctional landscape mosaics

IMPACTS ON PEOPLES' LIVELIHOOD

- food security
- cash income and market access
- health and nutrition
- risk reduction/aversion
- wood security: poles, firewood, fibers and so on
- animal health and productivity
- labour savings
- environmental service compensations

RISKS AND TRADE-OFFS

- ecological risks: invasive species, allelopathy, pests and diseases
- trade-offs: a) long rotation leading to postponed return on investment, b) balancing on-site benefits with off-site impacts
- competitiveness of agroforestry systems versus monocultures
- managing landscape mosaics which keep changing as a result of decisions by many individuals