Curriculum Development in Agroforestry

Proceedings of the first interregional workshop for Africa, Asia and Latin America

30 May–3 June 1994, Nakuru, Kenya

edited by

Per Rudebjer
August B. Temu

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Training and Education Report No. 29

INTERNATIONAL CENTRE FOR RESEARCH IN AGROFORESTRY



Participants in the first interregional workshop on curriculum development in agroforestry for Africa, Asia and Latin America, held from 25 May to 2 June 1994 in Nakuru, Kenya.

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Preface

The development and dissemination of agroforestry are constrained in part by the lack of people with the necessary specialized skills and knowledge. The challenge faced by universities and colleges in Third World countries attempting to incorporate agroforestry into their curricula is largely related to the need to: clarify concepts and approaches; look at institutional structures that do not easily accommodate multidisciplinary programmes; update the skills of academic and research staff; develop teaching materials; and strengthen the nexus between research and capacity building programmes.

The International Centre for Research in Agroforestry (ICRAF) has since the early eighties been involved in strengthening the capacity of universities and technical colleges to teach agroforestry at the postgraduate, undergraduate, diploma and certificate levels. In 1989, ICRAF launched its education programme, and in 1992, ICRAF led an initiative to establish the African Network for Agroforestry Education (ANAFE).

This report presents a summary of the proceedings of the first inter-regional workshop on curriculum development in agroforestry for Africa, Asia and Latin America, held from 25 May to 2 June 1994 in Nakuru, Kenya. This meeting was notable for several reasons: First was the realization that universities and colleges across continents have similar problems and may therefore adopt solutions from other regions. Second, the incorporation of agroforestry into curricula can, in one way or another, start **now—**without additional resources from donors and without major institutional changes. Third, more efforts are needed to raise the level of awareness and support for agroforestry education at policy levels. Fourth, the question 'what is an agroforester?' is becoming more and more clear and so are the competencies, skills and tasks required by the profession.

We trust that the **Plans of Action on Agroforestry Education** conceived by the workshop participants will become a reality and that reports on success/failure will continue to be shared among the members of the informal network of educators that met—for the first time—in Nakuru.

Ester Zulberti
Director of Training and Information
ICRAF

Acknowledgements

This proceedings and the workshop it summarizes, are the result of collective efforts by many individual contributors. The workshop was sponsored by the African Network for Agroforestry Education (ANAFE) through a grant from the Swedish International Development Authority (SIDA). The Training Programme at ICRAF also sponsored some of the participants.

Dr Ester Zuberti, Director of Training and Information at ICRAF provided guidance and inspiration throughout the planning and implementation of the workshop. Our thanks also go to ICRAF collaborators in Southeast Asia, Latin America and Africa for assisting in selection of participants and facilitating communication and logistics.

We are most grateful to Dr Samuel Mancebo, University of the Philippines, Los Banos, for his skillful leadership during the workshop. His input was vital for the understanding of the DACUM process.

At ICRAF headquarters, Mrs Milcah Mbindyo provided essential administrative support. Mrs Marie Kimenye and Ms Rita Mulinge gave valuable secretarial services needed to organize the workshop. We also thank Mrs Helen van Houten, ICRAF's editor, for advise on the layout of this report.

Finally a word of thanks to the workshop participants who generously shared ideas and experiences during the week.

The Editors

Summary

Institutions involved in agroforestry research and development point out the need for qualified human resources in agroforestry. Since this pool of scientists and development workers is provided by educational institutions, the starting point is to strengthen agroforestry education. A major component in any educational programme is a suitable curriculum. Since agroforestry is a relatively new subject, many educational institutions have expressed their desire to strengthen their capacity to teach it, as part of other land-use sciences. For this to be achieved, there is a need to develop and review the existing curricula.

ICRAF arranged an inter-regional workshop on curriculum development in Nakuru, Kenya, 25 May-2 June 1994, with the aim of exchanging ideas and experiences on agroforestry education and curriculum development in Africa, Asia and Latin America. The objectives were to enable participants to:

- make use of existing tools for curriculum development
- develop, improve and evaluate agroforestry curricula at their home institutions

The workshop gathered 20 participants from Africa (10), Latin America (5) and Southeast Asia (5). The central theme of the workshop was the introduction and testing of the DACUM (Developing A CUrriculuM) method for curriculum development. In a real situation, the DACUM process involves participation of employers, policy-makers, farmers, researchers, educators and business persons. In this case, the participants had to play the roles of those persons. As a result of the exercise, the participants developed a chart of duties and competencies/skills required for an agroforestry extensionist.

The participants received the DACUM process very positively, and recommended it for use in curriculum development in universities and colleges. The general view was that it is applicable for practical use in the home institutions. At the end of the workshop, most participants felt that they would be able to run a DACUM workshop themselves.

Using the DACUM process, the participants tested their skills by developing agroforestry training courses for extensionists and agroforestry courses at undergraduate level in agriculture and forestry.

The participants also made an inventory of current methods for curriculum development in use in their respective regions. Several methods were listed, showing a variety of approaches to the task. Often, the relevant ministry is the approving body for the new curriculum, while in other cases, such as universities in the Philippines and in Latin America, the final decision is taken by the university council. The inventory showed that employers are less involved in the process, but that their views are often captured through questionnaires or interviews, or through participation in workshops.

Within the respective regions there is a greater or lesser variation in the methods used for curriculum development. Colleges and universities in francophone Africa follow similar methods for curriculum development, and so do universities in Southeast Asia. Anglophone Africa, however, has not adopted a uniform approach to curriculum development. The inventory also showed that

each university in Latin America uses its own process for curriculum development.

Finally, the participants prepared indicative action plans for strengthening agroforestry education in the four regions. The action plans focus on the improvement of the quality of teaching staff and resources; on the needs in terms of curriculum development; and on improvement of teaching technologies.

Among the recommendations from the workshop, the importance of addressing policymakers in agroforestry education issues was particularly stressed. Cross-discipline and inter-regional forums for exchange of experiences, curricula, teaching material and methods, were also encouraged.

The status of agroforestry education in the participating institutions was captured in institutional presentations made during the workshop.

This proceedings contains the summary of the discussions and presentations. It is organized in three parts: The first deals with the DACUM process, the second presents the results from the group tasks conducted in the workshop and the third part consists of institutional presentations, focusing particularly on the status of agroforestry education at the participating institutions.

Recommendations

During a final plenary session, the workshop participants agreed on the following recommendations to strengthen agroforestry education in Africa, Latin America and Southeast Asia:

- The DACUM process of developing curricula is creative and can also be used to evaluate the contents of curricula. However, it needs strengthening by more examples and experiences from Africa and Latin America. Educational institutions should be encouraged to use it.

- While it is relatively easy to involve farmers, researchers, extensionists and business persons in curriculum development, the participation of policymakers is crucial. Special effort should be made to enlighten policymakers on the values of agroforestry in educational programmes.

- More opportunities should be made available for educational institutions to share experiences in curriculum development. Cross-participation between land-use disciplines should be encouraged.

- Exchange of curricula will strengthen collaboration especially in the sharing of resources. Regional meetings are encouraged.

- There should be a periodic review of agroforestry content in curricula that should be linked to the performance of graduates of the programmes.

- Workshop participants should organize at least one DACUM workshop before the next inter-regional meeting.

- The workshop proceedings should be distributed widely to educational institutions in Africa, Asia and Latin America.

- The inter-regional exchange of experiences was particularly useful in providing a consensus on the basic contents of agroforestry curricula. Since agroforestry is a growing field, follow-up meetings should be planned to review progress.

- In staff training, the importance of training techniques should not be overlooked. They should be guided in field surveys, the development of demonstration plots and data collection.

- The workshop was a very good example of South-South collaboration in educational programmes. More forums of this kind should be encouraged.

Background and objectives

As the demand for agroforestry expertise grows, educational institutions are taking up the challenges of delivering good quality education in agroforestry. The challenge includes, among other things, the incorporation of multidisciplinary land management approaches into agriculture, forestry and animal science curricula, and developing the capability to deliver the improved curricula.

The education programme at ICRAF provides opportunities for college and university lecturers to understand agroforestry through participation in ICRAF organized activities such as training courses, workshops and meetings. As a result of such activities, many educational institutions have expressed their desire to incorporate the newly learned knowledge and skills into their curricula. Some institutions have, fully or in part, adopted the course sequence and contents used by ICRAF, mostly for lack of better guidance. This is not always desirable because it is necessary to match the contents of a course with the objectives of the whole curriculum.

The knowledge and skills needed to develop curricula are quite specialized and are taught as part of pedagogics. It is interesting to note that the majority of college and university lecturers have not taken courses in pedagogics. Thus very few are familiar with the processes of curriculum development.

The main objective of this workshop was to facilitate an exchange of experiences on the processes used in developing and evaluating agroforestry curricula in Africa, Latin America and Southeast Asia. At the end of the workshop, the participants were expected to be able to:

- evaluate the strengths and weaknesses of agroforestry in existing curricula
- use existing tools for curriculum development
- facilitate the development of agroforestry curricula at the home institutions

The workshop produced the following outputs:

- an inventory of curriculum development processes used in the participating countries
- an evaluation of the DACUM[1] process of curriculum development
- action plans for strengthening agroforestry education at participating institutions

[1] DACUM is the acronym for Developing A CUrriculuM, a process developed in Canada and used widely in Asia

PART 1: Developing A CUrriculuM-DACUM

The concept, methodology and some applications on the DACUM process in developing an agroforestry curriculum

Samuel T Mancebo[2]

Introduction

Determining curriculum content for any vocational, technical or occupational education and training is very rewarding and yet extremely frustrating. The rewarding aspect is the final product: a content that may be actually used in the instructional environment to aid the learners to achieve their fullest potential. The frustrating aspect consists of identifying contents that are truly relevant to both instructional and occupational settings.

When the DACUM approach was created in July 1968 in British Columbia, Canada, it was described as 'an example of a systems approach to instruction[1]. Since then as it has been used in countries such as Australia, Indonesia, and the Philippines. It has evolved and been refined into a programme planning model, which is a methodology for analysing and describing learning outcomes within a job or an occupational area. It is a procedure for designing programmes. It is *not* a system of instruction.

DACUM concept and principles

Regardless of who uses the DACUM approach, and whether it is used to develop a programme in a small company or a complete programme for an entire occupational area, the basic principles remain the same. Like other competency-based approaches to curriculum development, it places the emphasis on the learners gaining the ability to meet specific objectives formulated according to a set of standards.

DACUM is based on three assumptions:

1. Expert workers can define and describe their job more accurately than anyone else.
2. Any job can be effectively described in terms of the tasks that successful workers in that occupation perform.
3. In order to be performed correctly, all tasks demand certain knowledge and attitudes from workers.

Broadly speaking, this approach uses a group-centred introspection approach involving representatives and curriculum developers in the creation of a nominated occupation or range of jobs within a specified career structure. Operationally, the result of the DACUM process is a chart that is 'a single sheet skill profile that serves as both a curriculum plan and an evaluation instrument for occupational training programme' (Adams 1975).

[2] Chairman, Department of Agricultural Education and Rural Studies, College of Agriculture, University of the Philippines at Los Barios, Laguna, Philippines

The quality of a DACUM chart is determined by several factors such as the panel members' technical knowledge and skill and their ability to express themselves, and the facilitator's ability to elicit specific, accurate skill statements, deal with conflict and debate, and maintain the group's momentum (Miller-Beach 1980).

The DACUM process and procedure

The process has four components: The selection of workshop participants; the DACUM workshop; data analysis; and development of a course.

SELECTION OF WORKSHOP PARTICIPANTS

The process requires careful identification and selection of one or two facilitators, a minimum of 8 but not more than 15 employer representatives or expert workers and a recorder. If the goal is to revise an existing programme, instructors may be added to this number of participants. These resource persons are nominated by employers as being skilled in the occupation and currently serving as workers or supervisors in the area. They should be articulate and forward thinking.

The facilitator directs the flow of the meeting, ensures maximum coverage of specific topics under discussion and elicits contributions from all participants. The facilitators' role is critical. The facilitator must be skilled in the techniques of task analysis and group processes and patient even when the process becomes tedious.

The DACUM recorder must quickly and legibly print each skill statement exactly as it is phrased by the panel. Like the facilitator, the recorder must refrain from comments that could influence panel members' determinations.

THE MODIFIED DACUM WORKSHOP

The workshop is the first step in the process of developing a competency-based training programme. Since educational and training programmes are aimed at producing graduates for employment in career, technical and vocational fields, it is important for educators to work with employers to determine what particular skills are required. The workshop provides a forum for consultation and for the negotiation of training goals. Briefly, the DACUM workshop has the following steps:

1. General introduction and orientation

The initial ice-breaking activity involves the facilitator's statement of the purpose of the meeting and the form it will take. The participants are told that the workshop involves the discussion and agreement on the relevance and priority of the various tasks identified.

2. Agreement on the span of positions to be analysed

The participants should focus on the range of positions within the career structure of the specific occupation that a particular course may cater for. Examples of positions are forest ranger, community forester or agroforester.

3. *Identification of the process-based duties and responsibilities of the position*

After the span of positions is agreed upon by the participants, each position must have a description of process-based duties and responsibilities, which the participants must also evolve. The process-based duties are a collection of activities that take one or more kinds of input and create an output that is of value to the end-user. For example, in business, 'work is usually broken into its simplest tasks and each of these is assigned to a specialist. The business managers then focus on the individual tasks in the process, e. g., receiving the order form, picking up the goods from the warehouse, and so forth. They tend to lose sight of the larger objective, which is to get the goods into the hands of the customer. The individual tasks within the process are important, but none of them matters to the customer if the overall process doesn't work—that is if the process doesn't deliver the goods' (Hammer and Champy 1993).

4. *Identification of the general areas of competence through task analysis*

Panel members identify the general areas of competence (basically composed of knowledge, skills and the willingness to do it) required as reflected in the process-based duties and responsibilities of the position. This step could be done in two ways. One way is that the facilitator draws the ideas from the participants orally through the brainstorming technique and writes them on the chalkboard. The other way is the KJ technique (from Prof. Kawakita Jiro, 1950-70) by using a card system in which the ideas are written by all participants at the same time and placed on the wall. Either way, a free dialogue and discussion take place.

An agreement by the panel members must be arrived at to finalize the list of competencies. These agreed upon categories are listed again on large cards and posted vertically on a blank wall in full view of the panel.

- Focusing only on one area at a time, skills/behaviour required in each of the categories are specified. Each skill statement is recorded on a card and posted beside the approximate duty or responsibility. Eventually, the category statement, together with skills statements, forms a 'competency band' in the chart.
- After the skills required in each category have been identified, panelists make sure that each skill statement is explicit and accurate.
- Then, skill statements are structured into a meaningful learning sequence. Panelists decide which skills they would have an entry-level worker learn first and apply on the job. The statements are then arranged in the order determined by the panel.
- Finally, the facilitator solicits the panelists' consensus regarding the accuracy of the chart. They should agree that it correctly reflects the skills required in that occupation.

By the time the DACUM conference is over, panel members have produced a graphic profile of the skills required in their work called the DACUM Chart, as shown in Chart 1. The DACUM profile or chart provides an independent specification of each behaviour or skill associated with competence in the occupation. These behaviours are stated in a rather simple manner so that the student can understand them, and are organized in small blocks on the chart in such a manner that each can be used as an independent goal for the student. The profile also

contains a rating scale that facilitates evaluation of achievement for each of the behaviours. In this manner, the profile may be used as a record of achievement for both student and teacher.

ANALYSIS OF DATA GATHERED

The materials generated after the conference are usually subjected to desk analysis whereby the information recorded on the cards is transferred to individual sheets of papers. During this process, the information is restated as behavioural objectives. Once the component tasks have been expressed as behavioural objectives, the teaching specialists are approached (usually in groups of two or four). They are asked whether they agree or not on the behavioural objective statement and if they wish to modify it and to estimate the time required to teach each topic referred to in the competency statement.

COURSE DEVELOPMENT

Once the estimates of teaching time are made, a sequence of topics to be taught is developed within the areas of competence identified by the industry representatives. After the development of the course outline, meetings of the teaching staff and industry representatives are held to review the proposed course. Once this is ratified by the group, detailed subject syllabi are prepared.

Some applications of the DACUM process[3]

As stated earlier, DACUM is not a system of instruction but a procedure or a system of designing relevant and appropriate education and training programmes. This 26-year-old Canadian procedure was introduced in the USA, Australia, Philippines, Indonesia, Republic of China (Taiwan) and other countries in the Asia-Pacific region.

In the Philippines, the process was used in evolving innovative agricultural programmes such as the development of the diploma in agricultural technology, BSc in agricultural technology, diploma/MSc in agricultural technology education, and diploma in agricultural entrepreneurship. It was also used in revising the existing BSc in agriculture, forestry, agricultural engineering and agroforestry programmes; and in developing non-degree programmes in post-secondary agriculture, vocational and technical education. The Indonesian experience was in the areas of analysis of training needs, in development of training programmes for field extension workers by the National Agricultural Training Institute and improvement of vocational technical education.

Although no formal evaluation has been done yet, the experiences gathered through observations and feedback received from the participants in the Philippines and the FAO expert consultation on Developing Curricula for Agroforestry and Community Forestry in the Asia-Pacific countries in June 1993 have shown satisfactory acceptance. The DACUM approach, as it is evolving and being modified by users, is a promising alternative approach that is quick, cheap

[3] Chart 1 gives a flow diagram of the DACUM process. Chart 2 is an examples of the application of DACUM to develop curricula at the University of the Philippines at Los Banos (UPLB)

and more realistic for developing formal and non-formal education programmes in the years ahead.

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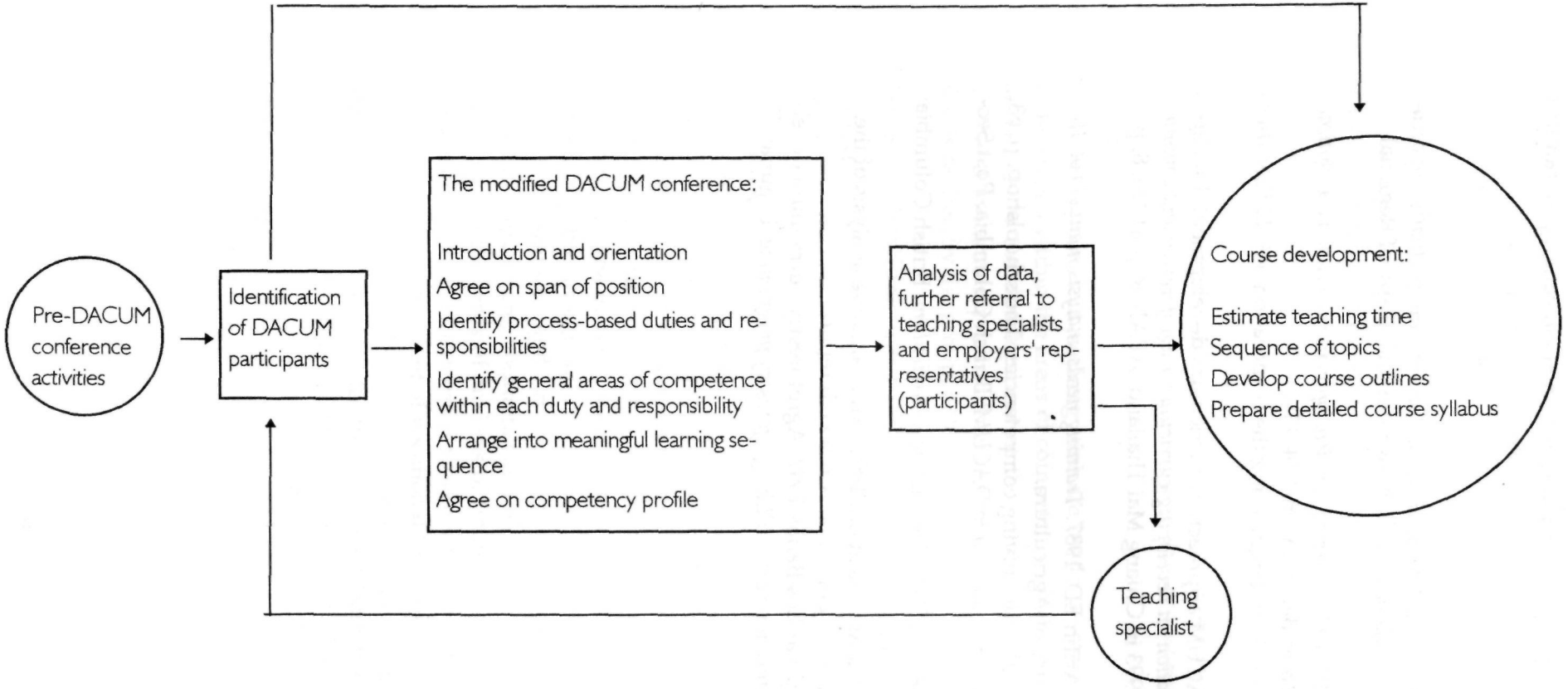


Chart 1. Process flow of the various components of the DACUM approach to curriculum development (Mancebo 1994)

Duties	Competencies (Skills/Tasks)						
A. Immerse and integrate with the community to establish rapport	1. Be able to work, live and communicate with people	2. Make regular visits to housesAarms	3.Be a good participant observer	4. Understand the dynamics of poverty in the community	5. Appreciate the cultural way of life of the community	6. Participate and facilitate community activities	7.
B. Conduct participatory systems appraisal with gender issues to be taken into consideration	1. Make a biophysical and socioeconomic characterization and analysis of the locality	2. Validate gathered information	3. Interpret the inter-relationship of the factors identified	4. Identify problems, constraints, needs and opportunities	5. Formulate recommendations	6.	7.
C, Prepare feasibility studies	1. Identify the projects	2. Conduct an analysis of the technical, management, social, economic, ecological and financial aspects/ considerations of the project	3.	4.	5.	6.	7.
D. Coordinate and collaborate with existing development initiatives and programmes	1. Know who, what, when, how and why of the different government and private agencies operating in the area	2. Define or strengthen the mechanisms for regular dialogue and effective coordination	3. Identify and revise the obstacles in the process of coordination	4.	5.	6.	7.
E. Plan and implement agroforestry projects	1. Design with intended partners the alternative agroforestry systems and other livelihood projects	2. Demonstrate various operations/processes required in the alternative agroforestry systems	3. Train the staff/ farmers/other clients	4. Prepare work and financial plan	5. Mobilize people to the tasks/jobs	6. Supervise, manage and organize resources	7. Adopt a financial and management recording system
F. Generate, verify, transfer, promote and share technology	1. Identify the needs, gaps and problems	2. Design and operationalize the research mechanism	3. Analyse, interpret and verify the results	4. Piloting and commercialization of technology	5. Design and apply extension mechanism/ strategies	6. Develop entrepreneurial capability of the clients	7. Promote the practice of sustainable agroforestry technology for socio- economic productivity
G. Monitor and evaluate agroforestry projects	1. Identify the performance indicators	2. Formulate/use the tools and techniques in M&M	3. Identify and recommend alternative courses of action	4. Prepare and submit accurate, brief and comprehensive reports	5.	6.	7.

Chart 2. Competency nnatrix for UPLB agroforester competency profile.
Prepared by the UPLB DACUM workshop of November 22, 1992, UPLB, chart design by ST Mancebo, 1993

The DACUM process — experiences from the workshop

Testing **the DACUM** process

The first task was to make all the workshop participants familiar with the DACUM process. This was achieved with the help of a facilitator. The outcome of the discussions was:

- development of a common understanding of what a curriculum is
- agreement on the stake-holders that should participate in a curriculum development process
- understanding the basic steps in a curriculum development process
- agreement on the need for curriculum development in agroforestry
- agreement on the job profile for which the agroforestry curriculum would be developed

Participants discussed the various jobs of an agroforester and agreed that the most important one is that of an agroforestry extensionist. It was agreed to develop a curriculum for this job.

The second task was to divide participants into groups of stake-holders. Each participant chose to belong to one of the following groups:

- farmers
- development workers/extensionists
- educators/researchers
- business persons/employers
- policymakers

These groups served as the role players. Heated debates ensued in each group and among groups as they discussed the subsequent topics, which were:

1. to identify the duties of an agroforestry extensionist
2. to list the competencies/skills needed to execute each duty listed

For each of these topics, the following procedure was followed:

1. Participants wrote down their ideas on cards. Only one idea could be put on a card, and an individual could write down as many ideas as desired
2. All the ideas were posted on the wall for the plenary discussions
3. The group debated each idea and defended it in plenary discussions
4. The facilitator went through one idea at a time and participants helped to group similar ideas together. Duplications were eliminated
5. Each group of ideas was then re-phrased to the satisfaction of the workshop
6. The list of competencies was re-organized to form a logical sequence

The DACUM chart

The final list of duties required for an agroforestry extensionist, as agreed by the workshop participants, is displayed in the first column of the DACUM chart. The subsequent columns describe the competencies, skills and tasks identified for each duty to complete the DACUM chart as in Chart 3.

Outcome

The whole process took two days. It was highly participatory and lively. Participants were excited by the entertaining discussions and satisfied with the outcome. It was agreed that the further identification of subjects and topics needed to achieve the expected skills/competencies was the job of educators. It was also recognized that in doing that, educators would continue consultations with the stake-holders.

The idea behind the workshop was to give the participants an opportunity to go through a DACUM exercise, rather than to produce a tangible curriculum. However, to make the exercise complete, the DACUM chart developed by the workshop participants was used to develop agroforestry training courses for the four regions. Due to the time constraint, this was only a brief demonstration of the final step in the curriculum development process. In this group task the usefulness of the DACUM approach to curriculum development was demonstrated, and was appreciated by the participants.

Duties	Competencies (skills/tasks)					
1. Understand the farming system and land-use approach	Identify and classify components of FS land-use approaches and socio-economic factors	Consider traditional land-use knowledge	Appreciate farmers' preferences and decisions on farming practices	Interpret land tenure and land-use practices	Interpret and draw maps	
2. 'Possess' broad knowledge of AF technologies	Understand the importance of practicing AF	Acquire adequate knowledge of production factors in the farming practice	Explain the components of an AF system and their interaction	Select relevant AF technologies in response to farmers' needs	Apply and evaluate AF technologies	Upgrade and update continuously his/her knowledge of AF
3. Identify and understand farmers' needs and problems	Have ability to communicate with farmers	Willingness to live in farmer community	Organize surveys and transform results into extension actions	Categorize farmers' problems and needs, and distinguish those that can be solved by AF technologies	Assist communities to prioritize farmer needs and problems	Find out farmers initiatives in solving their problems
4. Assist farmers to improve and manage their farming practices for maximum benefit	Identify markets for AF products	Advise on diversification and management of AF practices	Coordinate and facilitate farmers' access to quality inputs	Apply for research results to increase farmers' benefits	Communicate with professionals in agriculture, forestry, animal husbandry, social sciences and other related specialties	
5. Transfer technology from research to farmer appropriately	Understand the social and cultural behaviour of the society he/she is dealing with	Identify the best ways of adapting AF technologies for farmer acceptance	Know the methods of transferring AF technologies to farmer practice	Relate with both researchers and farmers	Formulate action plans using extension methods that are gender sensitive and responsive to farmers' needs and problems	
6. Help farmers design appropriate AF farming practices	Make accurate diagnosis of the problems	Select appropriate interventions of AF practices	Prepare work plan **and** financial proposals	Assist to set up and implement AF practices	Monitor and evaluate AF practices	
7. Plan, implement, monitor and evaluate AF projects	Prepare a comprehensive AF project plan	Translate plans into activities	Follow-up on activities as planned	Design methods for assessing performance of AF projects with the farmers and other collaborative institutions	Assess the performance of the AF project and recommend possible courses of action	Prepare and submit comprehensive periodic and final reports
8. Help identify AF research agenda	Liaise with farmers as well as researchers	Participate in testing/Validating research on farmers' fields and translate results into a research agenda	Be sensitive to and raise environmental issues to be addressed by the research agenda	Identify knowledge gaps between the farmer and the researcher		

Chart 3. DACUM profile of duties and competencies of an agroforestry extensionist, prepared by workshop participants

Evaluation of the DACUM process

Having finished the DACUM exercise, the participants evaluated the process, with the objective of improving the approach and its presentation. There was consensus that the DACUM process is applicable for practical use in various stages of curriculum development. In one of the institutions it has already been applied. With a few exceptions, the group felt that the DACUM approach is not too complex, and that it could be easily adopted and replicated in the home institutions. The doubts that were raised were that it is time consuming and needs funding and a good facilitator.

The DACUM process was found to be useful for identifying both future training needs for a certain occupation, and realistic competencies to be developed in a programme, such as non-formal education, education for self-employment and training for extension workers. However, workshop participants felt the exercise would have been more realistic, had employers with professional experience in the discipline been present.

The participants' opinion was that the facilitation of the DACUM process during the workshop was excellent, and the message therefore brought home effectively. An experienced person is needed who can guide the participants with minimum influence. The grouping of the participants during the exercise worked out well, although some felt that the plenary group should have been smaller. The strengths of the process are that:

- the output has a high credibility, since it involves all parties: lecturers, employers, policymakers, etc.
- it is comprehensive, flexible and relatively easy to apply.

The weaknesses, as noted above, are related to time and money and the dependence on a good facilitator. The success also depends on the commitment of the participants.

Asked how the participants themselves would run a similar workshop, many answered that they would follow the same pattern, while others felt that they would need the assistance of an expert. Some suggested making it more multidisciplinary, and providing information about DACUM in advance. The importance of bringing awareness of DACUM to policy-makers was also stressed.

In conclusion, they considered DACUM to be a very interesting and useful exercise, and recommended it for use in curriculum development in universities and colleges. They appreciated the work in interdisciplinary groups, with people representing different regions and institutions, and found it interesting and challenging. The DACUM approach is a good way of putting together different views to reach a consensus.

PART 2: GROUP TASKS

Inventory of methods for curriculum development

Anglophone Africa

INTRODUCTION

Several methods are used for curriculum development in anglophone Africa. Each country normally has more than one method, and the same method might be applied differently from one country to another. This paper presents the various methods but does not go into a detailed analysis. Table 1 describes each method and summarizes the strengths and weaknesses.

Table 1. Curriculum development methods in anglophone Africa

Initiative	Description of method	Strengths	Weaknesses
Government	Government identifies need competencies and develops curriculum	Immediate implementation	May lack lecturer commitment
	Curriculum passed to institution for implementation	Has governmental support	Lack of academic flexibility
Lecturer	Lecturer identifies competencies and develops curriculum	Implementer is key player	Employers may not be involved
	College curriculum passed to academic dean and Ministry		Difficult to implement
	Academic curriculum to dean, senate & council		May reelect personal interest
Department	Departmental board identifies competencies and develops curriculum	Commitment from lecturers	May fall short of employers' requirement
			May be theoretical
Employer	Employer identifies competencies and participates in curriculum development through workshops and questionnaires	Assessment of competencies more reliable	Very long & cumbersome process
		Solutions more reliable	Difficult to accommodate all interests
	Evaluation of students or feedback from alumni	Commitment from all parties	

GOVERNMENT-INITIATED CURRICULUM

In this method, the government identifies a particular discipline to be introduced in the country. Such a discipline could be agroforestry. The decision may be taken at the ministerial level or even at parliamentary level. Then the government identifies the required competencies and designs a curriculum. The curriculum is then passed on to the relevant institutions for implementation. A government-initiated curriculum can be implemented immediately because it has political and financial support. However, it may lack certain academic inputs.

LECTURER-INITIATED CURRICULUM

In the lecturer-initiated curriculum development process, the lecturer identifies competencies that can be taught at the institution and develops a curriculum. In case of technical institutions (pre-university), the curriculum is passed on to the academic dean, and then to the teaching staff board for discussion and approval. The curriculum is forwarded to the relevant ministry for approval and implementation.

In the case of universities, the lecturer forwards the proposed curriculum to the head of the department and then to the departmental meeting. If approved, the curriculum is taken to the faculty board for discussion and approval, then sent to the senate and finally to the university council, which is supposed to give final approval for implementation.

The strength of the lecturer initiative is that the designer of the curriculum also will be committed to its implementation. However, employers may not be involved in the curriculum development process and the curriculum may not adequately address employer requirements. A lecturer-initiated curriculum may also be difficult to implement because of the long process it has to go through before it is approved, and because it may reflect the personal interest of the lecturer.

DEPARTMENT-INITIATED CURRICULUM

A department-initiated curriculum is in principle similar to the lecturer-initiated curriculum. The main difference is that it is a collective effort of all the lecturers in the department. Essentially, the department meeting identifies the competencies and develops a curriculum. The process of implementation is the same as the one described for the lecturer-initiated curriculum development process.

Its main strength is that it has the commitment of all the lecturers. One of the weaknesses is that it may fall short of employers' requirements, since the employers are usually not consulted. Hence department-initiated curriculum may be theoretical.

EMPLOYER-INITIATED CURRICULUM

In the employer-initiated curriculum development process, the employer identifies competencies to be taken up by the relevant institution. In this case, the employer participates in the process through workshops, questionnaires and evaluation of students. The alumni may also give feedback on required competencies. The procedure for implementation of employer-initiated curriculum development is more or less like that of lecturer- and department-initiated ones.

The employer-initiated curriculum gives a more reliable assessment of competencies from the employer's view point than all the other three methods. Therefore, solutions are more reliable and there is a commitment from all parties involved in the curriculum implementation. However, the employer-initiated process is very long and cumbersome and it may be difficult to accommodate all the interests of the parties involved.

Francophone Africa

In both colleges and universities in francophone Africa, methods for the development of programmes and curricula are similar. A faculty task force is appointed to carry out the following duties:

1. Visit similar institutions to assess the status of various programmes and courses, review available human and physical resources, and assess needs of staff and students.
2. Evaluate the existing curriculum based on the results obtained from the visits to and surveys of the institutions, and if necessary decide to review the curriculum.
3. Carry out a survey with the purpose of getting feedback from various sources associated with the institution. These include the alumni, employers, similar foreign and national faculties, national agricultural societies (NARs), farmers, farmer associations, NGOs and other government associations. Questionnaires are developed and circulated to collect this information.
4. Convene a workshop with the people mentioned above, to identify the functions and needs of the training they deem necessary to serve the region.

A committee of education specialists and teachers is selected to transform the functions and needs of training into a draft curriculum. This committee identifies student and staff needs, defines specific objectives and teaching strategies and develops course structure and content.

During a second workshop, the draft curriculum is studied to see if it is adaptable and serves the needs, and to determine if the graduates produced will meet the expectations.

The approved curriculum is tried for a period of time. It is monitored and evaluated, and then fully implemented.

The strongest point in this method is the wide consultations, where many groups contribute. Therefore there is general commitment to implement the curriculum. The graduates may have a good market since the employers are aware of the education. The main weaknesses are that the system is expensive in terms of finances, human resources and time. It is also difficult to involve all participants at the same time, because of other commitments.

Latin America

The Latin American group identified three methods that are applied in the universities at undergraduate and graduate levels. In Latin America, each university develops its own curricula, using methods that differ from one university to another. In the case of Peru, universities usually rely on curricula developed by the older traditional universities. In general, universities in Latin America are autonomous, thus changes in curricula are approved by the university council.

In Table 2, three methods used in Peru and Mexico are described. The first of these is a special case of curriculum development, where a faculty was established on request from the community of Yurimaguas. Thus it may not be representative for Peru. The second example is a curriculum developed in the Universidad Nacional Agraria La Molina (UNALM), located in Lima. UNALM was created in 1902 and has been the cradle and foundation of Peruvian agricul-

tural education for research. The process of curriculum development has many similarities to the DACUM process. Example three is a curriculum that was developed for a new master's programme in agroforestry at the autonomous university of Yucatan. This curriculum is one of three new master's programmes in agroforestry in Mexico that were developed 1994.

Table 2. Three curriculum development methods used in Latin America

Initiative	Method	Developer	Approval	Revision	Strengths & Weaknesses
Community of Yurimaguas	Feasibility study Collection of curricula of different universities Adaptation to the ecoregion Professional profile Curriculum development	Dean Professors	Faculty council Academic vice rector University council	Periodical	Strength: Fulfills ecoregional needs Weakness: Lack of personnel for curriculum development
The University (UNALM-PERU)	Revision of National Assembly of Universities' objectives Evaluation of the economic, social and ecological situation of the country Professional profile Curriculum definition with methodology like DACUM	Dean Professors Students Employers	Faculty council University council	Every 5 years	Strength: Involvement of the employers Weaknesses: Lack of financial support Lack of coordination among institution
New programme in the faculty of veterinary medicine and animal science, Mexico	Definition of programme objective Feasibility study Curriculum revision of all natural resources curriculum in the country Professional profile	Faculty professors Professors from related faculties	Faculty dean University council	For the first two years every year	Strengths: Fulfills an existing gap in the Yucatan Developed by multidisciplinary team Weaknesses: Lack of coordination among the institutions Scarcity of developers

Southeast Asia

INTRODUCTION

The basic principles of developing curriculum in universities in Indonesia, the Philippines and Thailand are similar. The initiative for curriculum development usually comes from the faculty. This is because the faculty is the centre of aca-

demic activities. In the case of Indonesia and Thailand, the final decision on curriculum development is in the hands of the Ministry of Education (Indonesia) or Ministry of Higher Education (Thailand). In the two countries, the government plays an important role in every aspect of education activities. In the Philippines, the university has autonomy to develop curricula without necessarily getting approval from the government. The DACUM process has been used in the Philippines, but is relatively new in Indonesia and Thailand.

PROCESS

The general curriculum development process of Southeast Asian universities is depicted in Figure 1 below. There are a number of actors involved in curriculum development. The faculty sets up a curriculum committee whose main task is to draft a curriculum that could be submitted to the university curriculum committee. To prepare the draft, the faculty committee conducts a survey by sending questionnaires to individuals or institutions related to the proposed curriculum. It is also common that the faculty committee visits related institutions. These activities aim at gathering all important information relevant to the proposed curriculum. Based on this information the faculty committee designs/drafts a curriculum that then will be discussed in a workshop-initiated by the committee.

The workshop is considered to be a very important part of the process, and experts, employers and other related persons are invited. The main objective of the workshop is to comment on the curriculum and finalize the draft. This second draft will then be sent to the university curriculum committee.

The main task of the university curriculum committee is to review the proposed curriculum from the university point of view. In this step, there are usually few changes in the content of the proposed curriculum, and the proposal is then forwarded to the university council. In the case of the Philippines, the university council is the body that is in the position to decide whether the curriculum proposal is accepted or not. But in Indonesia and Thailand, the decision is in the hands of the appropriate education ministry. The ministry will make a decision after receiving recommendations from the national curriculum committee set up by the ministry.

STRENGTHS AND WEAKNESSES

The main strength of this process is that the competencies of graduates are based on the real need of various institutions as gathered through a survey, workshop, tour, etc. However, there are some weaknesses of this process. It is time consuming, expensive and may involve unnecessary intervention from the government, especially in Indonesia and Thailand.

CONCLUSIONS

To some extent, DACUM has already been used in Southeast Asia. However, the users generally do not know that the method they have been using in developing curricula is similar to that of DACUM. It does seem that most Southeast Asian universities use a combination of DACUM and other techniques in developing their curriculum.

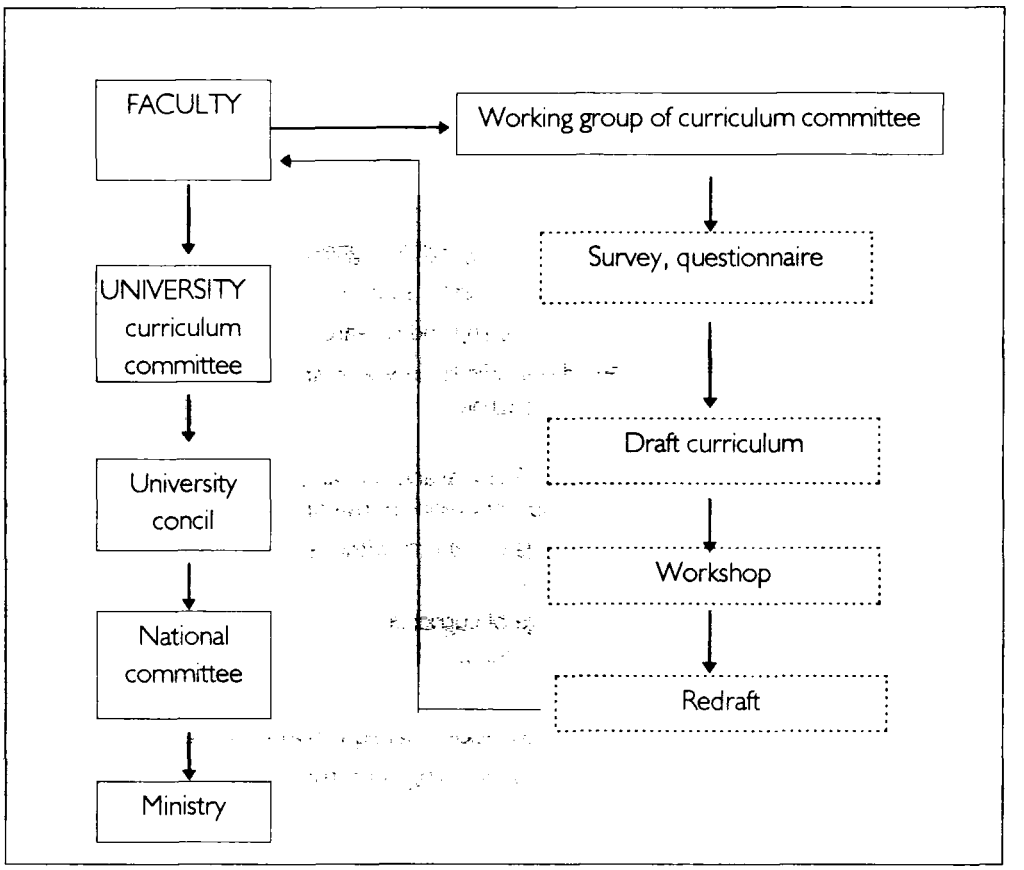


Figure 1. The general curriculum development process in Southeast Asia.

Indicative action plans for strengthening agroforestry education

During the workshop, the four regional groups prepared indicative action plans for strengthening agroforestry education in the respective region. Each group identified, discussed and synthesized ideas on how to develop the agroforestry curriculum and its implementation, as presented in Tables 3-6. They focused the discussion on the following three areas:

- Improvement of the quality of the teaching staff and resources
- Curriculum to be designed or developed
- Instructional or teaching technologies to be provided or improved

Anglophone Africa

Table 3. Indicative action plan for strengthening agroforestry education in Anglophone Africa

Area	Action
Quality of the teaching staff and resources to be improved	Train teaching staff to highest possible level
	Train agroforestry support staff
	Prove teaching and research resources
	Hold periodic review workshops within the region for staff teaching agroforestry
Curriculum to be designed or developed	Provide financial and human support to hold curriculum development workshops/conferences at various institutions
	Exchange of experts within a region for DACUM workshops
	Exchange of curricula
Institutional or teaching technologies to be provided or improved	Provide of MPTs database and computers
	Upgrade audio-visual equipment and aids
	Assist in developing demonstration plots
	Supply of agroforestry journals, textbooks and related literature

Francophone Africa

Table 4. Indicative action plan for strengthening agroforestry education in francophone Africa

Area	Action
Quality of the teaching staff and resources to be improved	Arrange regional workshop (to define strategic plan and curriculum development for training the trainers)
	Train of trainers
	Provide staff exchanges
	Award fellowships and internships
	Attend ICRAF training courses
Curriculum to be designed or developed	Incorporate separate agroforestry course into the existing curriculum at BSc level
	Develop an MSc degree programme in agroforestry at regional level
	Develop an agroforestry curriculum for technical colleges
	Develop curriculum for in-service training for extensionists
Institutional or teaching technologies to be provided or improved	Acquire library materials (textbooks, charts, journals, etc.)
	Establish agroforestry demonstration plots and nurseries
	Increase the use of computers and software (databases, CD-ROM, etc.)
	Encourage use of audio-visual equipment; video, overhead and slide projectors

Latin America

Table 5. Indicative action plan for strengthening agroforestry education in Latin America

Area	Action
Quality of the teaching staff and resources to be improved	National level: Inventory agroforestry education in institutions Organize national meeting to define educational and research lines in agroforestry, in short and long term Agree on staff exchange with experiment stations, thus building infrastructure and networks Make joint efforts to obtain financial support for implementation of agroforestry research and education Peru: Prepare joint proposal between universities for establishment of agroforestry plots Regional level: Hold regional workshop in Mexico on teaching materials Conduct institutional inventory of agroforestry education Strengthen FAO agroforestry network in Latin America Exchange experiences and advances in agroforestry education Coordinate and exchange agroforestry curricula between nations
Curriculum to be designed or developed	Peru: Agroforestry course establishment at BSc level
Institutional or teaching technologies to be provided or improved	Arrange regional workshops such as the teaching materials workshop in Mexico Open the doors of all Latin American institutions offering courses, workshops and training, programmes for participants from other Latin American countries

Southeast Asia

Table 6. Indicative action plan for strengthening agroforestry education in Francophone Africa

Area	Action
Quality of the teaching staff and resources to be improved	Staff development
	send staff for graduate studies on agroforestry and related fields of specialization
	send staff for training workshops, conferences, etc.
	encourage and support staff to get more involved in research, extension and other work related to agroforestry
	Provide appropriate educational resources (i.e., lab equipment, research station, etc.)
Curriculum to be designed or developed	Integrate agroforestry into the existing BSF/BSA curricula in natural resources management
	Develop agroforestry curricula for MSc and PhD levels
	Develop short-term training programmes/courses for technicians, professionals and farmers
Institutional or teaching technologies to be provided or improved	Introduce/improve computer technology in agroforestry research and teaching
	Develop more teaching materials on agroforestry (i.e., slides, manuals, handbooks, etc.)
	Acquire more agroforester references and printed materials
Collaborative activities	Maintain/strengthen linkage and cooperation among organization and institutions (i.e., ICRAF, APAN, FAO, SEARCA, etc.)
	Exchange of information continuously on research results and related development through publications, newsletters, etc.
	Promote staff exchange among concerned universities
	Promote exchange of students under the university consortium

PART 3: INSTITUTIONAL PRESENTATIONS

Botswana College of Agriculture

Faculty of Agriculture
University of Botswana
Gaborone, Botswana
Peter P. Rabanna

General

Botswana College of Agriculture (BCA) is located at the Content Farm, Sebele, about 10 km north of the city centre of Gaborone, the capital. It is situated in the vicinity of other Ministry of Agriculture departments such as the Department of Agricultural Research (DAR,) Estate Management Unit (EMU), Denman Rural Training Centre (DRTC) and Southern African Centre for Cooperation in Agricultural Research (SACCAR). BCA was established 1991, and today has five departments:

- Crop science and production
- Animal science and production
- Agricultural engineering and land planning
- Agricultural economics, extension and education
- Basic sciences

Number of staff:	58 teaching, 21 technical support
Total Student Enrollment	330
Academic year:	August-May
Language of instruction:	English

History and present status of agroforestry education

The college teaches both crops science, animal science and production based courses. Only a year or two ago a course on forestry and range management was introduced. A recently formed steering committee deals with the development of an agroforestry education curriculum. The committee is chaired by the programme tutor in crop science and production, and is made up of representative lecturers from different disciplines, i.e., one member from each of the above departments.

The course on integrated production systems will in the future be tailored to encompass agroforestry education. At the moment, however, not much special attention is paid to agroforestry education, which is a constraint, and teaching materials such as relevant texts and audio-visual materials in agroforestry are still in short supply.

The college works cooperatively with the Agricultural Research Station scientists where integrated research on livestock, crops and range management are carried out. Scientists at the college are encouraged and readily sponsored to explore the area of agroforestry education.

A new Centre for In-Service and Continuing Education (CICE) has been established at the college. The main purpose of the centre is to contribute to the

agricultural development of Botswana by providing quality short courses in agriculture and closely related rural development fields to staff of the Ministry of Agriculture in particular and other relevant departments of government, private institutions and to commercial farmers.

Dinderesso National Institute of Forestry (ENEF)

Dinderesso, Burkina Faso
Jean-Pierre Hema

Historical note

The Dinderesso National School of Forestry was founded in 1953 at Dinderesso, located at about 15 km from Bobo-Dioulasso in Western Burkina Faso. It was formerly called School of Forestry Guards, and recruited and trained former soldiers as *Preposes des Eaux et Forets.* In 1972 it became the National School of Forestry delivering a certificate programme in forestry *(Techniciens).* The entry requirements were a special admission test after primary school.

From 1984, the National School of Forestry was given a national mandate for all professional training in forestry, offering three distinguished programmes:

1. *certificat* d'*Aptitude professionnelle* (CAP) programme
2. certificate programme *(Techniciens)*
3. diploma programme *(Controleur)*

The main objective is to train students to sensitize the rural population in all environmental issues and provide them with guidance and tools in the management of natural resources, mainly trees.

The school is directly attached to the Ministry of Environment and Tourism.

Programmes, duration and awards

CERTIFICAT D'*APTITUDE PROFESSIONNELLE* (CAP)

Entry requirement: To have a primary leaving certificate, completed at least the first two years of the secondary school and to pass a special examination

1. Programme duration: 1 year
2. Award: *certificat d' aptitude professionnelle*
3. Student enrollment: 40 students annually

CERTIFICATE PROGRAMME

1. Entry requirement: 'O' Level certificate and pass a special examination
2. Duration: 2 years
3. Award: Certificate in Forestry
4. Student enrollment: 25 students annually

DIPLOMA PROGRAMME

1. Entry requirements: 'A' Level certificate and pass a special examination
2. Duration: 2 years
3. Award: diploma
4. Student enrollment: 15 students annually

EDUCATION POLICIES

All development of the school should be aimed at adapting the content of the programmes to the needs of the farmers, taking into account environmental challenges. Its current public status requires the school to meet the rapid evolution of needs in natural resources management in the country

In-house strategy

- To provide relevant improved programmes adapted to the needs of the country
- To organize relevant short courses for the trainees, taking into account innovative technologies and extension approaches
- To strengthen the teaching capacity and capabilities of the school

Other strategies

- To develop close collaboration with other equivalent professional training centres in agriculture in curriculum evaluation and qualification assessment
- To develop mechanisms for programme evaluation and incorporation of feedback from the trainees and their employers

The University of Dschang

Faculty of Agronomy
Dschang, Cameroon
Tchanou Zachee

General information

The city of Dschang, where the university is located, has a population of 40000 inhabitants and is situated 350 km north of the capital Yaounde. Dschang is linked to the capital and to the main port, Douala, by good roads.

Dschang is in the western province of Cameroon at 5° 30' north of the equator, at an altitude of over 1400 m above sea level. This makes the climate pleasant with an average maximum of 23° C and an average minimum of 11° C. The rainy season extends from March through to October with an annual rainfall of 1900 mm.

The University of Dschang was created in 1993 and comprises the faculties of agronomy, sciences, economics, arts and law. Before 1993, the training of agriculturalists and foresters was under the role of Faculty of Agronomy which has existed since 1962. The training of foresters at the university level began only in

October 1978. Agroforestry at that time was taught as a small chapter within the silviculture course. This situation lasted almost 12 years. In October 1989, a four-year BSc curriculum was developed with emphasis on the practical aspects of training as well as the bilingual nature of education in French and English.

Education in agroforestry falls under the Faculty of Agronomy, whose fundamental mission is to contribute to the development and promotion of a dynamic agriculture in Cameroon and Africa, which will enhance and sustain economic and social development'. In the achievement of this mission, these efforts will seek, in a global sense, to increase farmers' income, ensure food self-sufficiency and security, increase export earnings and protect the environment. The mission is fulfilled through:

- an adaptive teaching programme that will produce competent, self-confident and competitive professionals
- an appropriate applied, adaptive and basic research programme to increase agricultural production and productivity
- an efficient and dynamic outreach programme that is client-oriented

Programmes

The four-year curriculum in the Faculty of Agronomy comprises two years of common core subjects and two years of specialization in the field of agricultural mechanization, animal production, crop science, economics and rural sociology, forestry and wildlife.

Before 1993, the intake was 100 students each year from secondary schools. After two years of common core courses at least 25 of them usually choose forestry. The creation of the university in 1993 resulted in a big increase in the number of students involved in agronomy training—from 100 to 300. This means that in future the number of students involved in forestry training will increase.

Present status of agroforestry education

In the new four-year BSc curriculum, agroforestry is taught as a separate course for fourth-year students as a common course. This means that foresters, crop scientists, animal scientists and agricultural engineering scientists take the same agroforestry course at the end of their training in the Faculty of Agronomy. The course content as taught now comprises: Introduction, background, definition and concepts, agroforestry systems analysis, diagnosis and design methodology, agroforestry practices and technologies, socioeconomic aspects of agroforestry, multipurpose trees, agroforestry risks and their palliatives.

Teaching materials and research

There are no specific teaching materials for agroforestry training apart from the books, journals and slides brought from ICRAF headquarters.

In terms of research, some MPTs have been planted around the main building of the department of forestry. There is strong collaboration between the local ICRAF station based in Yaounde and the faculty through the involvement of students in data collection and analysis in permanent ICRAF plots. At least 15 end-of-study reports have been done at ICRAF field station in Yaounde.

University of Science and Technology (UST)

Kumasi, Ghana
EL Jampoh

Establishment

The Institute of Renewable Natural Resources (IRNR) of the University of Science and Technology (UST) is currently responsible for the teaching of agroforestry. The institute was established in October, 1982, upon a recommendation by the Ministry of Lands and Natural Resources and the Ghana Forestry Commission. It was charged with the responsibility of promoting the proper management and utilization of Ghana's forests, savannas, wildlife, fresh-water fisheries and watersheds, through teaching, research, publications and extension.

The departments of the institute are:

- Department of silviculture and forest management
- Department of wood science and wood technology
- Department of wildlife and range management
- Department of freshwater fisheries and watershed management

Agroforestry, under the present system, is housed by the department of silviculture and forest management.

Programmes

The institute trains both professional and sub-professional personnel and offers courses leading to:

- 2-year diploma in natural resources management
- 3-year BSc in natural resources management
- 2-year MSc programme in wood science and wood technology
- 2-year MSc programme in agroforestry
- 2-year MPh programmes in:
  - Forestry
  - Agroforestry
  - Wildlife management
  - Range management
  - Applied fish biology
  - Watershed hydrology
  - Wood science

Since its establishment the institute had trained a total of 356 graduates as at the end of the 1993 academic year. The breakdown by programme is the following: 225 BSc; 120 Diploma; 5 MSc wood science ; 5 MSc agroforestry and 1 MPh. Between 29 and 71 students have graduated each year.

Curriculum

Agroforestry is taught as a single course in the final year at the BSc level. This course introduces students to the concepts, principles and practice of agroforestry. Agroforestry aspects are also incorporated into related subjects (such as silviculture and multiple land-use). Students have also written **a** number of theses particularly on evaluation of agroforestry projects in the country.

The MSc programme combines both course work and thesis. The course work consists of core courses and special courses.

Entry requirements

The MSc agroforestry degree programme is open to holders of first-class or second-class (upper division) degrees in natural resources management, agriculture, or biological sciences. Graduates in other disciplines with relevant field experience are also considered for admission.

Plans for development of agroforestry education

Plans are far advanced for raising the present status of the agroforestry unit into a full department. When this is accomplished it will still concentrate on postgraduate education and research.

Teaching materials

IRNR has a number of resource personnel (lecturers and senior technicians) who oversee the teaching and research activities of its programmes. In addition the institute has a research farm where agroforestry research and demonstrations are carried out. Currently the farm has permanent plots for alley farming, oil palm (under which, it is proposed, livestock will graze) and woodlots of various species. Also fallow management and continuous assessment plots have been established.

Constraints to agroforestry education

- The agroforestry unit is perpetually faced with financial difficulties in its bid to promote research. This has been so because it has to draw on the limited funds allocated to the department of silviculture and forest management, which has been accommodating the unit. The result is that the unit is not able to embark fully on agroforestry research.
- Personnel who have been trained to teach agroforestry sometimes go for further studies, thus leaving a few people at any one particular time to handle the ever-increasing number of students.
- Teaching materials, including textbooks, are inadequate.
- The unit has difficulty bringing in external examiners because of lack of funds.
- The number of computers and accessories for analysing results of experiments is not adequate.

Collaborative activities in agroforestry research and teaching

The Institute collaborates with a number of institutions and organizations as far as agroforestry education and research are concerned. These include:

- Alley Farming Network for Tropical Africa (AFNETA): The IRNR has a multidisciplinary team drawn from the Faculty of Agriculture, UST, Forestry Research Institute of Ghana (FORIG); Faculty of Environmental and Development Studies: and the IRNR itself, which collaborates in the execution of the AFNETA project. There are two main experiments, namely:

1. MPT screening and evaluation
   - continuous assessment of 10 MPTs
   - alley farming with 10 MPTs
2. Fallow management

The first experiment is executed at two sites, in the derived savanna forest zone at Asempaneye and in the forest zone at UST campus in Kumasi. The second experiment has been established at the UST only.

- Agroforestry Research Networks for Africa (AFRENA): diagnosis & design of the humid lowlands of Ghana was done at both the macro and micro levels. The first phase has ended and research proposals for the second phase need to be funded now.

- Cooperative Integrated Project on Savannah Ecosystems (CIPSEC): The agroforestry unit collaborates with CIPSEC on agroforestry activities in the savanna ecosystems of Ghana.

- NGOs: The institute is an integral part of the Yensi Valley Farming which is under the Ghana Rural Reconstruction Movement, an NGO. In addition the institute continues collaborating with community churches participation and development in agroforestry.

- Canadian Universities Service Organization (CUSO): In northern Ghana the IRNR collaborates with CUSO, which is currently involved with agroforestry interventions in the degraded areas.

- Lakehead University: In collaboration with Lakehead University of Canada, the IRNR has embarked on environmental literacy efforts. This programme is carried out in association with the University of Ghana and two other universities in Canada.

- African Network for Agroforestry Education (ANAFE): Three students, one each from Cameroon, Zambia and Ghana, are sponsored by ANAFE and are currently pursuing courses leading to the MSc in agroforestry.

Moi University

Eldoret, Kenya
William Mureithi

General

Moi University, established in 1984, is situated approximately 300 km northwest of Nairobi. It is located 35 km southeast of Eldoret town in Rift Valley Province. At the moment the university has about 7000 students on three campuses, the main campus, Chepkoilel campus and Maseno university college.
Moi University is composed of the following faculties and schools, which offer various degree programmes:

- Faculty of Education
- Faculty of Forest Resources and Wildlife Management
- Faculty of Information Science
- Faculty of Technology
- Faculty of Agriculture
- Faculty of Health Studies
- School of Environmental Studies
- School of Social, Cultural and Development Studies
- School of Graduate Studies
- Faculty of Science

Professional education in forestry started at the University of Nairobi in 1977. The department of forestry was later transferred to Moi University in 1984 to form the nucleus of the first academic programme. This department was expanded into a full-fledged Faculty of Forestry Resources and Wildlife Management. The department is therefore the oldest in Moi University. The number of students taking professional education in forestry has grown from 83 in 1984 to 180 in 1994. About 15 are postgraduates.

Curriculum development

Moi University, being a newly established university (only 10 years old) and with very many new departments, had to develop curricula that meet the growing demand of the rapidly changing modern technological society. The curricula have been reviewed with the change in the education system in Kenya. The review of the curricula is aimed at making the graduates of Moi University competitive in the labour market, meeting the demands of employers, and the development needs of this country and equipping graduates with sufficient knowledge for postgraduate studies.

In the department of forestry, the curriculum has been designed so that both the training and research programmes focus on the problems of rural development. The curriculum therefore aims to meet the following objectives:

- To provide a broad-based training in the discipline of forestry
- To equip forestry graduates with sufficient basic and professional courses facilitating the pursuit of postgraduate training leading to research, academic, extension and higher management careers

Because of the diversity of resources from forest lands (wood products, water, forage, wildlife, recreation environmental quality, etc.) the design of the curriculum recognizes and takes into account the multidisciplinary nature of forestry. The undergraduate programme therefore contains a diversity of courses that range from basic sciences to applied courses in forestry, wood science, economics, management, agroforestry, etc. In addition to the undergraduate programme, postgraduate training leading to MSc and DPh degrees in forestry are offered by the department through the School of Graduate Studies.

Agroforestry education

Agroforestry has been taught in the department of forestry since the inception of this department at the University of Nairobi in 1977. Under the old education system, where the duration of the degree course extended over six semesters

(three academic years), the curriculum required students to take one compulsory course in agroforestry (i.e., agroforestry, rural forestry, or forestry extension). This was a three unit course, equivalent to 80 contact hours. Agroforestry systems was offered as an elective course to those willing to take an advanced course in agroforestry.

Under the present 8-4-4 education system where the duration of the degree course extends over eight semesters (four academic years), the curriculum gives more focus to rural forestry. The 8-4-4 programme requires that undergraduate students take three compulsory courses in the area of rural development forestry. The courses are:

- Social forestry and extension 3 units
- Agroforestry 3 units
- Arid land forestry 3 units

There are plans to further develop agroforestry education in the department. The department has designed a curriculum for the postgraduate programme. This year (1994) there are 15 graduate students, 6 of whom specialize in the field of agroforestry. The department views agroforestry largely as a postgraduate programme, and a proposal has already been written to split the current department of forestry into four departments, one of them being the department of agroforestry, social forestry and extension.

The proposal was necessitated by the fact that a multidisciplinary field such as forestry needs discrete departments to make teaching and administration of academic and research programmes more efficient. A more focused department such as agroforestry would be able to review curricula and offer courses that give specialized direction on both training and research needs.

It is hoped that a department with narrower scope can easily secure funds for research projects. It is easier for such a department to develop and foster linkages with established research and teaching institutions. It is also easier for young scientists to come back to the department with clear teaching and research goals. The head of such a department will be more intimately familiar with the subjects taught in the department.

Under the current structure, this department does not have teaching staff specialized in agroforestry and relies on part-time lecturers from Kenya Forestry Research Institute (KEFRI), Egerton University, University of Nairobi and ICRAF. The university is reluctant to employ or even train staff in the field of agroforestry, the argument being that forestry is over-staffed, but forgetting the multidisciplinary nature of agroforestry.

The department has had collaborative activities in agroforestry extension and education with several institutions such as ICRAF, KEFRI, University of Nairobi, Egerton University, etc. The major constraints facing agroforestry include lack of/insufficient teaching staff, laboratory and field equipment, computers, transport facilities, books, journals, etc.

Ecole National Superieure d'Agriculture of Thies (ENSA)

Thies, Senegal
Saliou Ndiaye

Presentation

The Ecole Nationale Superieure d'Agriculture (ENSA) was created in 1983 with the objective of educating agronomy engineers, retraining governmental staff or private persons in the scope of agriculture, stock breeding, forestry and rural engineering, and also conducting research in this context. There are five departments at ENSA:

- Plant production
- Animal production
- Social science
- Soil and economy
- Rural engineering

Facilities

The campus has an area of 7 ha with classrooms and some laboratories well equipped for soil science, animal food and husbandry, plant production (crops), entomology and phytopathology. Other equipment is related to personal computers and various field materials in soil science, topography, etc.

Field work is carried out in agriculture, forestry, livestock breeding and related areas. ENSA has a farm of about 18 ha for crop production, fruits and legumes. Research in plant production, horticulture and soil science is going on there. For livestock breeding there are buildings for sheep, cattle, chicken and rabbits.

Education programmes

The agronomy engineer's education is five years, divided in three parts:

1. 2 years for basic sciences
2. 2 years for general agriculture, forestry, stock breeding, etc.
3. The last year for specialization in one of four fields:
    - Rural economy
    - Plant (or vegetable) production
    - Animal production
    - Rural engineering

The institution has developed relationships with several local and foreign research laboratories of research and with development institutions. The main focus is to share experiences and allow our students to do some training with them.

A course in agroforestry is delivered in the fifth year (in plant production) for 20 contact hours. The course is given by a forestry researcher, who has participated in an ICRAF training course. This subject is considered as a complement to the forestry subject given in the fourth year for 30 hours.

MARTI—Uyole Training Institute

Mbeya, Tanzania
J A Mbuya

General

The Southern Highlands Zonal Research and Training Centre, hereafter referred to as MARTI-Uyole, is one among the seven research and training zone centres in Tanzania responsible for agricultural research and training. These zone centres serve specific agroecological areas, with MARTI-Uyole focusing on the southern highlands regions. The regions include Mbeya, Rukwa, Iringa and Ruvuma. They occupy more than a fourth of the total land area of Tanzania and have a population accounting for 17% of the whole population of Tanzania.

MARTI-Uyole started as a public corporation called Uyole Agricultural Centre (UAC), established by a presidential decree in 1976. The building of the centre's headquarters was the result of an agreement between the Nordic countries (Norway, Sweden, Finland, and Denmark) and the government of Tanzania. The UAC continued to operate as a parastatal organization until June 1993, when it assumed the new status and title as MARTI-Uyole. It is located in Mbeya, about 800 km southwest of Dar es Salaam.

Two major activities are undertaken by MARTI-Uyole:

- Research in crop and livestock
- Training of extension staff at certificate and diploma levels.

Education programmes

Agricultural training started with a short course in agromechanization. The certificate and diploma courses started as from July 1976. Currently, three diploma course programmes are offered: 1) animal production; 2) crop production; and 3) food production. The duration of diploma programmes is usually two years.

The only certificate programme conducted in the country is a three-year course in crop and livestock production. The main objective of this course is training extension agents to assist farmers in all aspects of farming systems. Thus one extension agent would be required per village as opposed to having several single discipline extension agents in the same village.

MARTI-Uyole has the following student intake for the 1994/95 academic year:

- Certificate in crop and livestock production—100/year for 3 years
- Diploma in animal production—30-45 students in alternative years
- Diploma in crop production—60 students in alternative years
- Diploma in crop production—25 students in alternative years

In addition there is a retraining programme of 200 students per year running concurrently with the certificate programme. Both are sponsored by the International Fund for Agricultural Development (IFAD). According to the policy memorandum between IFAD and the Tanzanian government, MARTI-Uyole will train 300 CALP students and retrain certificate extension agents in either crop or livestock skills for the southern highlands regions over a period of five years starting in 1993.

Curriculum review

All training institutes under the Ministry of Agriculture in Tanzania follow curricula centrally developed and supervised by the training department of the Research and Training Division. Institutes, therefore, are required only to implement the curricula as per guidelines from the Ministry of Agriculture headquarters. The Assistant Commissioner Training is responsible to the Ministry for all training tasks. The review of the curriculum is supervised by the Ministry of Agriculture with representation of subject matter specialists from the institutes. Reviews are normally done every five years; however, specific needs may necessitate reviews. Some of the newly introduced subjects include agroforestry and farming systems research approaches. The last review of the current curricula was in 1990, when agroforestry was introduced.

Agroforestry is a new concept in agriculture training, thus a lot of development of staff is required. Teaching of the subject has depended on information obtained from ICRAF courses, in which members of the institute have participated. Reference material is also a limiting factor in the teaching of agroforestry. Thus collaborative work with ICRAF in acquiring information accumulated on the subject is highly recommended.

Nyabyeya Forestry College

Masindi, Uganda
Edward K Mupada

Introduction

The first forestry school for technical training in Uganda was built in 1937 at Kityerera in what is now Iganga District in Busoga. The school offered elementary forestry to Africans who were assisting in the management of Crown forests. The school at Kityerera was closed in 1941 due to an outbreak of sleeping sickness in the area.

In 1948, the Forestry School was re-opened and transferred to Nyabyeya, to buildings constructed by Polish refugees during the Second World War. Formal training leading to a Certificate in Forestry started. An in-service diploma course was initiated in 1955. The diploma course was partly tenable at Nyabyeya and partly in the United Kingdom at the Dean Foresters' School, Gloucestershire.

Nyabyeya Forestry College is located some 240 km north of Kampala and 32 km west of Masindi town in western Uganda on the Masindi-Butiaba road, at the southern edge of Budongo Forest Reserve. It is situated on an undulating plateau of around 1300 m above sea level. The hill upon which the college is built affords views over the natural high forest and mountains in Zaire across the western Rift Valley.

Training

Nyabyeya Forestry College offers a two-year certificate and an 18-month diploma course in forestry. Candidates for the certificate course are holders of Uganda Certificate of Education (Ordinary Level) or its equivalent. The diploma

course is in-service. Currently the college has a total of 67 students for certificate class, 12 women and 55 boys. The diploma training was suspended in 1986 due to the effects of war in the country, but it is hoped that the programme may resume later this year.

The college also runs in-service training, and is currently managing the EC-funded nature conservation training courses for forest staff. The college has a staff of 13 lecturers, three of whom are European volunteers.

Facilities

The college has just undergone a major rehabilitation funded by the World Bank, under the Forestry Rehabilitation Project. This has provided renovated buildings, a new classroom block, water pump and vehicles, but as yet little in the way of teaching equipment.

Transport facilities include a tractor, a mini-bus, two motorcycles and three pick-ups The power supply to the college is erratic, although there is a back-up generator available when necessary.

The college has a forest reserve area of 347 ha, consisting of about 200 ha of forest plantation. In addition, the college has a small tropical high forest reserve of 135 ha designated as a nature reserve.

For recreational activities, the college has tennis and volley ball courts and a football pitch. A satellite dish for CNN news has been installed.

Curriculum development process

The diploma course does not have an independent curriculum; the teaching is based on the curriculum for the certificate programme. Nyabyeya Forestry College has put it as a matter of priority to develop a diploma course curriculum. It was hoped that by June 1994, when the diploma training might be resumed, a new curriculum would be in place.

To aid the curriculum development process, a curriculum development and evaluation committee was set up in June 1993. The committee visited Londiani (Kenya) and Olmotonyi (Tanzania) to familiarize themselves with the curricula in use at the forestry colleges in those countries. As part of the information gathering process, questionnaires were also sent out to forestry staff working with the forestry department, to employers of forestry technicians and to Makerere University, Ugandan NGOs, communities, employers and individuals to further determine training needs. It is planned that a multidisciplinary group will come together to develop a new curriculum.

Most of the funds for work on the curriculum development process have so far come from the Regional Soil Conservation Unit (RSCU) of the Swedish International Development Authority (SIDA) based in Nairobi, Kenya.

History and present status of agroforestry education

Agroforestry was introduced at Nyabyeya Forestry College in 1989 as part of community forestry and forestry extension. Under the FAO training programme, which started in 1988 and ended in 1990, agroforestry was not treated as an independent course with an independent curriculum.

From about 1992, agroforestry acquired a more prominent role after the lecturer attended an agroforestry workshop organized by ICRAF in Kenya. Nevertheless, agroforestry is still treated as part of community forestry.

Agroforestry is currently only taught in the certificate programme. It is hoped that with the general curriculum development process at the college, agroforestry will also be included in the diploma programme.

Plans for the development of agroforestry education

Currently not much work is under way towards the development of agroforestry education. However, a few things are under consideration. Some of these include setting up an agroforestry demonstration farm and an agroforestry arboretum, and designing teaching materials.

Constraints in agroforestry education

The main constraints in agroforestry education include: Lack of comprehensive lecture notes, lack of accessibility to agroforestry demonstration sites, inadequate agroforestry teaching materials, inadequate reference materials and no dedicated agroforestry curriculum

Inventory of teaching materials in agroforestry education

The following teaching materials in agroforestry is available at the college:

- *Teaching manuals and notes:* Model course for agroforestry teaching at certificate and diploma education, by Bjorn Hansson
- *Teacher's manual on agroforestry in dryland Africa,* by James N. Ngumy
- *Agroforestry extension training sourcebook* by CARE
- *Agroforestry sourcebook support materials* by CARE
- Community forestry teaching notes
- Forestry extension teaching notes

Reference Materials:

- *Agroforestry in dryland Africa,* by D. Rocheleau, F. Weber and A. Field-Juma
- *Fruits of our work-women in community forestry in Tanzania* by Maria Berlekom
- *A field guide - Agroforestry in Kenya,* by Amare Getahun and Reshid Kidir

Agroforestry slide series:

- Agroforestry systems and practices in developing countries
- Agroforestry in dryland Africa

Agroforestry video cassettes from ICRAF:

- The promise of agroforestry
- Agroforestry
- Fruits of our work: Women in community forestry in Tanzania
- Looking after our land: New approaches to soil and water conservation in dryland Africa

Collaborative activities in agroforestry research and education

Support to the development of agroforestry education has come from ICRAF/ANAFE. The SIDA/RSCU has also funded the curriculum development process at Nyabyeya Forestry College. There is need for collaborative activities in agroforestry research and education especially with national agroforestry scientists and researchers, with sister institutions in the region and with agroforestry agencies such as ICRAF and CARE.

Bukalasa Agricultural College

Bukalasa, Uganda
Kizza JE Ssenkabirwa

General

Bukalasa Agricultural College was established as an agricultural station in 1922. Since its establishment it has played various roles in research and training of staff, students and farmers. It is located 50 km north of Kampala on the Kampala road in Luweero District, in the 'tall elephant grass' ecological zone. The zone experiences a bimodal type of rainfall, i.e., March-June and August-December. There are two dry spells, one in July and the other in January-February.

The college has 10 departments:

- Crop science and production
- Animal science and production
- Agricultural sciences and agroforestry
- Agricultural extension and education
- Agricultural engineering
- Animal health
- Agricultural economics
- Home economics
- Hides and skins
- Farm management

Programmes

The college offers certificate and in-service diploma programmes, each one of them two years. The programmes and the annual intake are shown in Table 7.

Table 7. Programmes and annual intake at Bukalasa agricultural college

Programme	Annual intake
Certificate in agriculture	100
Certificate in veterinary sciences	80
Certificate in hides and skins	10
Certificate in cooperatives	45
In-service diploma in agriculture	45
In-service diploma in veterinary sciences	25
In-service diploma in farm management	10
In-service diploma in dairy technology	30

Curriculum development

The present curriculum was last revised in 1976 and is presently being reviewed by a task force of Makerere University, Kampala. In this new curriculum we will be admitting only 'A[1] level students who have done biological sciences at higher school certificate level (HSC) and who have passed at least two major subjects with credits. With the new curriculum, BAC will offer three-year diploma courses in: agriculture, animal husbandry, farm management, horticulture, home economics, range management, dairy science, meat and food hygiene and entomology.

Our total capacity *will* be 500 students. We will follow the semester system and the college will be linked to Makerere University. This will enable the bright students to enter the university straight on completion of their diplomas.

Agroforestry education

The new curriculum includes an introductory course in forestry, and a separate course in agroforestry will be given with the following suggested content:

1. Introduction to agroforestry
   - Concept and definition of agroforestry
   - Scope and importance of agroforestry
   - Examples of agroforestry in land-use systems
2. Agroforestry systems
   - Agrosilvipastoral systems
   - Silvipastoral systems
   - Agrosilvopastoral systems
   - Other systems
3. Major agroforestry technologies
4. Establishment and management of agroforestry systems
   - Components in agroforestry and their arrangements
   - Tree/crop interaction
   - Tree/animal interaction
   - Multipurpose trees
   - Selecting suitable tree species
   - Tree establishment methods for different agroforestry technologies
   - Management of agroforestry systems
5. The role of agroforestry in soil conservation
   - The role of trees in improving soil productivity
   - Agroforestry practices in soil conservation
6. Diagnosis aspects of agroforestry
   - Economic concepts of agroforestry
   - Social considerations

University of Zimbabwe

The Faculty of **Agriculture**
Harare, Zimbabwe
Ephraim M Govere

The University of Zimbabwe

The University of Zimbabwe (UZ) is situated on 250 acres about 7 km north of the Harare city centre. The university started as the University College of Rhodesia and Nyasaland in 1955. It became the University of Rhodesia in 1971, and finally the University of Zimbabwe in 1990. The overall number of students increased from 68 in 1957 to 2240 in 1980 and about 12000 in 1994.

The university has 10 faculties: agriculture, arts, commerce, education, engineering, law, medicine, science, social studies and veterinary studies.

Altogether, there are 80 departments within the faculties, and a total teaching staff of 856 and technical support staff of 600. The principal officers of the university are the Chancellor (the President of Zimbabwe), the Chairman of the University Council (appointed by the Government of Zimbabwe), vice-chancellor, two pro-vice chancellors, registrar, and bursar. Faculties are headed by elected deans, and departments are chaired by appointed chairpersons. Both dean and chairperson positions run for a term of three years and candidates can be re-appointed for no more than two terms.

The Faculty of Agriculture

Agricultural sciences are taught in the Faculty of Agriculture which was established in 1980. The number of graduates rose from 12 in 1980 to 102 in 1993. The number of MPhil and DPhil students rose from 12 in 1980 to 50 today. The number of courses taught at undergraduate level in the faculty is over 50. More recently the faculty diversified and intensified its teaching into areas such as horticulture and agricultural engineering.

Agroforestry education

While the Faculty of Agriculture and the University of Zimbabwe as a whole have enjoyed a considerable reputation of excellence in teaching and research, there is one area that needs serious attention—the area of agroforestry education. There is no course, not even half or quarter of a course, in agroforestry offered at the University of Zimbabwe. There is however, some agroforestry related research going on and there are plans to introduce a course entitled agroforestry at BSc and MSc levels. The BSc level course will be introduced starting 1995 while the MSc level course will be introduced in 19%. Students in the Faculty of Agriculture with majors in soil science, animal science, crop science or agricultural economics and extension will be encouraged to take the agroforestry course. There are also plans to teach agroforestry as one of the courses in the BSc agriculture degree programme by distance education.

The main constraint to teaching agroforestry has been the lack of qualified teaching staff interested in agroforestry. The faculty now has a staff member with a degree in forest management and agronomy who has been tasked with the responsibility to develop agroforestry courses. The curriculum development workshop will be of great help in this process.

Brawijaya University

The Faculty of Agriculture
Malang, Indonesia
D Kusnadi

Introduction

The knowledge of agroforestry at the Faculty of Agriculture, Brawijaya University, Malang, Indonesia (UNIBRAW) is still little developed. There are five departments, namely: crop protection, agricultural technology, soil science, socioeconomics of agriculture and agronomy. The latter three departments are involved in the development of agroforestry.

In the department of agronomy, the teaching of agroforestry is given in a subject named 'Wana Tani', which means agroforestry, and covers the concept of agroforestry, classification of agroforestry systems, the use of agroforestry in soil conservation, managing erosion and soil fertility maintenance. It also discusses the constraints of agroforestry, the future of agroforestry for poor farmers and the use of agroforestry on marginal land. In other departments, it is still given as part of the watershed management and agricultural extension subjects. The reason is that this field is only recently developed and there is lack of staff with background in agroforestry. In addition, the availability of references in the Malang language, is far from sufficient.

There are large forest areas in Indonesia in general and in East Java in particular. As a faculty located in the region of East Java, UNIBRAW is participating to support the government in solving agroforestry problems. The support is in the form of joint research and curriculum development and design, promoting the development of agroforestry science.

To handle the agroforestry problems, there is a cooperation between the faculty and the department of forestry to conduct joint research. The topics range from social agroforestry, the development of agroforestry farmers' groups, soil conservation, erosion in the forest area, etc.

The development of agroforestry at the Faculty of Agriculture, Brawiaya University

The development of agroforestry science at UNIBRAW is getting more and more important for a number of reasons:

- UNIBRAW has several departments that can accommodate the development of agroforestry such as soil science, agronomy and socioeconomics of agriculture.
- More and more research is conducted by UNIBRAW and the forestry department to solve agroforestry problems. It means that UNIBRAW should

start to consider preparing graduates having the knowledge in agroforestry.
- Cooperation with ICRAF has been established to handle agroforestry problem in Lampung (Sumatra).

However, there are constraints in the development of agroforestry at UNIBRAW, such as lack of expertise and insufficient references. Therefore, UNIBRAW is giving priority to staff training by sending academic staff to attend seminars, workshops, etc., where they can increase their knowledge in agroforestry. The training can be in-country or overseas. By attending such activities, it is expected that the horizon and the knowledge of the academic staff in agroforestry will be broadened and improved.

Conclusion

The involvement of the academic staff from the Faculty of Agriculture Brawijaya University in training, research and seminars in the area of agroforestry will encourage the development of agroforestry science. In particular activities conducted by ICRAF will accelerate the development of agroforestry at UNIBRAW.

Andalas University

Padang, West Sumatra, Indonesia
Zainul B Kimart

Introduction

Andalas University has nine faculties: medicine, law, economics, animal husbandry, agriculture, engineering, art and culture and social politics. In addition the university has two polytechnics: agricultural polytechnic and engineering polytechnic.

The Faculty of Agriculture and Faculty of Animal Husbandry are agricultural faculties in the wide sense. The Faculty of Agriculture has five departments: agronomy, socioeconomics, soil science, plant pests and diseases, and agriculture technology. The Faculty of Animal Husbandry has two departments, animal nutrition and socioeconomics of animal husbandry.

The Faculty of Agriculture was established in 1954 and the Faculty of Animal Husbandry in 1963. Neither faculty has agroforestry or forestry subjects, though they do offer agronomy, soil science, horticulture, etc. The number of students in the Faculty of Agriculture is 1270; the Faculty of Animal Husbandry has 900 students. Both faculties are located in Padang town, the capital of West Sumatra Province.

The curriculum development process

Our curriculum consists of:

- General basic courses: physics, chemistry, mathematics, etc.
- Skills courses: agronomy, soil science, pests and diseases, etc.
- Local needs courses: crops, animals, etc.

General basic courses are developed by the Minister of Education and Culture, the skills course by the consortium of agriculture, and local needs course by the university.

Status and development of agroforestry

Since 80 % of the people of West Sumatra live in agricultural or rural areas, and we have **a** lot of forest, an agricultural or forestry education would be very desirable.

The Faculty of Agriculture could teach agroforestry and spread out to farmers through training and demonstrations. The constraints to agroforestry education include the lack of expertise in agroforestry and lack of teaching materials.

Gadjah Mada University

Faculty of Forestry
Indonesia
S Sambas and H Iswantoro

Introduction

The Faculty of Forestry at Gadjha Mada University was established in 1963 and now has four major programmes: silviculture, forest management, forest technology, and forest conservation. The total number of staff and undergraduate students in 1994 is about 75 and 700 respectively.

The agroforestry course is one of the compulsory courses for students majoring in silviculture and has been taught since the early 1980s. For other students, this course is considered as an elective. There are basically four groups of courses in the curriculum of the faculty. The first group is 'general basic courses' and are mandatory for all students in the university. The second is called 'faculty basic courses'; they are compulsory for all students in the Faculty of Forestry. The third is 'programme courses'; which must be taken by students under the given programme, and lastly 'elective courses' are offered to all students in the university.

Agroforestry syllabus

The syllabus for the agroforestry course is as follows:

1. Introduction (week 1)
   - History of agroforestry
   - Definition and concepts
   - The role of agroforestry in forestry development

2. Classification of agroforestry (week 2)
   - Structural basis
   - Functional basis
   - Socioeconomic basis
   - Ecological basis
3. Agroforestry systems in the tropics (week 3)
   - Distribution of tropical agroforestry systems
   - Tropical environment
   - Agro-ecological spread of tropical agroforestry systems
4. The existing agroforestry technologies (weeks 4 and 5)
   - Shifting cultivation
   - Improved fallow
   - Alley cropping
   - Crop under tree cover
   - Animal production and agroforestry
   - Other technologies
5. Multipurpose trees and shrubs and agroforestry (week 6)
   - The role of multipurpose trees in agroforestry
   - Fodder trees
   - Fuelwood trees
   - Fruit trees
6. Component interactions (weeks 7 and 8)
   - Above ground interactions
   - Below ground interactions
7. Soil and agroforestry (weeks 9 and 10)
   - Effect of trees on soils
   - Nutrient cycling and soil organic matter
   - Nitrogen fixation
   - Soil conservation
8. Socioeconomic aspects of agroforestry (weeks 11 and 12)
   - General principles of economic analysis
   - Financial and economic analysis
   - Important socio-cultural factors in agroforestry
   - Social acceptability of agroforestry
9. Diagnosis and design (weeks 13 and 14)
   - Definition and concepts
   - Procedures in conducting diagnosis and design (D&D)
   - Case studies
10. Agroforestry evaluation (weeks 15 and 16)
   - Biological concepts
   - Socioeconomic concepts

The course is handled by two lecturers, Dr Sambas Sabarnurdin and Mr Heru Iswantoro.

Literature

The two main books used in teaching are:

MacDicken KG and Vergara NT. 1990. *Agroforestry: classification and management.* New York: John Wiley and Sons.

Nair PKR. 1993. *An introduction to agroforestry.* Dordrecht, The Netherlands: Kluwer Academic Publishers.

Related activities

The faculty has established some agroforestry trials either in collaboration with other institutions or by individual staff of the faculty. The faculty manages a 600 ha research field, located about 35 km from campus, which is used for conducting the trials. In addition, the faculty manages a research forest of about 50000 ha in Jambi, Sumatra. This forest is now being developed for undertaking forestry research, including agroforestry.

The University of the Philippines

Los Banos College
Laguna, Philippines
Rowena D Cabahug

Introduction

The UPLB agroforestry programme (UAP) was created in March 1991. The UAP aims to institutionalize a university-wide programme on agroforestry science and technology geared towards the development of agroforestry professionals and the generation as well as the dissemination of appropriate technologies.

Specifically, it aims to:

- Help strengthen existing programmes and develop new curricula in agroforestry
- Develop, implement and coordinate a comprehensive agroforestry research programme that will generate technologies that are culturally acceptable, technically feasible, economically viable and environmentally sustainable
- Formulate and implement agroforestry extension programmes that involve GOs and NGOs in testing, extending and using appropriate technologies, and
- Design and implement agroforestry and upland related projects in response to emerging policy changes and development thrusts.

UAP serves as the coordinating body of all agroforestry-related activities of the University of the Philippines/Los Banos through its three-fold functions of instruction, research and extension. The instruction division is aimed at the institutionalization of relevant agroforestry programmes at the formal education level. The research division is mandated to conduct basic and applied research in agroforestry with focus on documentation, evaluation and development of sustainable agroforestry technologies. The extension division is tasked to continu-

ously promote the effective dissemination and use of agroforestry technologies among technicians, farmers and other intended beneficiaries. This is accomplished through the two major outreach programmes of UAP, namely Agroforestry Technical Assistance (ATAS) and the UPLB Programme for Upland NGOs (UPUN).

Curriculum development process

UAP organized a curriculum development workshop in November 1992. The DACUM technique was used to determine the expected competencies and skills required of agroforestry professionals and employers in agroforestry. Based on this, a panel of researchers, academicians, and other agroforestry 'experts' from the government, NGOs, and international organizations identified the needed curricula programmes at the undergraduate and graduate levels and a programme for non-formal education in agroforestry

A number of outputs were produced during the four-day workshop such as the definition of agroforestry, a DACUM chart of required competencies and skills of agroforestry professionals, proposed curricula for undergraduate training courses in agroforestry.

Based on the workshop results, agroforestry curriculum working groups for undergraduates, graduate, and non-formal education were formally created. These working groups reviewed and assessed recommendations during the workshop.

To develop/design and implement the UAP short-term training courses, however, a series of steps had been undertaken: identification of areas for capability building (through consultation/workshop); training needs assessment (survey); course design and revision (course management team); training materials production and revision; training implementation and conduct of follow-up activities.

History and present status of agroforestry education

Agroforestry education in UPLB, particularly at the College of Forestry, started in the 1980's with the offering of agroforestry courses in the department of silviculture and forest, and influence as well as the department of social forestry. Some of the courses then offered were: fundamentals of agroforestry; special topics in agroforestry; management of agroforestry and swidden farming systems.

At present, specialization in agroforestry is being offered under existing major fields such as silviculture, forest resources management, social forestry, agronomy and horticulture at the MSc and PhD levels.

Likewise, a number of training programmes on agroforestry have been developed and implemented by some institutions within the university, such as those being implemented by the UPLB agroforestry programme (UAP).

Short courses

Conducting short-term training courses is an strategy to backstop the technical knowledge and skills of upland development workers, especially in the absence of sufficient formal training in agroforestry. The current short-term training courses of UAP are: agroforestry project planning and management,

(started 1993), seed technology and nursery management, integrated pest management, soil and water conservation and management, agroforestry production and post production systems and technology verification through on-farm trial. This year, UAP has started conducting some of these training courses in the regions or outside of the university. This is an initial attempt to answer the clamour by some NGOs to bring this training to their respective regions.

Recommendations from working groups on agroforestry education

The agroforestry working group for undergraduate education recommended the institution of a major in agroforestry in the existing BSc agriculture and BSc forestry degrees. Responding to this recommendation, new advanced courses have been proposed in addition to the existing agroforestry courses. Meanwhile, the BSc agriculture curriculum is currently being revised considering the committee's consensus that the present major fields (i.e., agronomy, horticulture, etc.) could be tailored to give students training in agroforestry.

The working group for graduate education recommended that the diploma and MSc programmes in agroforestry be offered jointly by the college of forestry and agriculture and coordinated by the UPLB agroforestry programme. It is the committee's perception that the offering of a PhD programme in agroforestry may still be premature at this time. The report of the working group is now being studied by proper university bodies.

The agroforestry curriculum working group for non-formal education identified the needed and appropriate non-formal training programmes in agroforestry as: project benefits, monitoring and evaluation and evaluation; theoretical and practical aspects of community organizing and community development; facilitation/communication skills for GO/NGO cooperation; rapid appraisal tools and techniques for agroforestry; participatory mapping and modeling for agroforestry and farm record keeping and accounting.

Plans for the development of agroforestry education

With the outputs of the three working groups for agroforestry curriculum now at hand, the UAP is more than challenged and committed to implement such recommendations.

The BSc Forestry major in silviculture and agroforestry is set for implementation this school year (1994-95). For the MSc and PhD programmes on agroforestry, on the other hand, follow-up activities are necessary, such as a brainstorming session with the standing curriculum committees of the colleges and forestry and agriculture to discuss appropriate actions for the formal institution of these programmes.

Concerning the identified topics for non-formal training, it is planned that a market survey be developed for the new identified courses.

One of the UAP's plans is to initiate an agroforestry education network in the Philippines. This is necessary not only to identify common concerns and problems but also to streamline the differences in the objectives of each institution. Establishing linkages with international experts is also being considered. Initially, networking would require a survey to identify institutions offering agroforestry education/training courses, after which a workshop can be organized where these different institutions could meet.

Constraints to agroforestry education

The lack of a formal programme in agroforestry is considered a constraint to agroforestry education. Within the university, there is really no identified institution mandated to offer agroforestry (lack of institutional base). If agroforestry education is set to be developed, this would require a corresponding financial support which the university may not yet have as of this time.

Inventory of teaching materials in agroforestry education

The UAP has available teaching and reading materials not only for agroforestry but for other upland development concerns. The UAP maintains a library that is continuously being equipped with more reading materials as subscription for various publication materials, both local and international, goes on.

Basic equipment such as a slide projector, overhead projector, computers and the like are also available. Other teaching materials that the UAP may not have are available in other units or departments of the university and there is always a way of sharing resources .

For laboratory/practical purposes, the UAP maintains a 3.5 ha research and demonstration farm. It serves as a demonstration area for training and also as a research site for the staff and students who are conducting their theses.

Collaborative activities in agroforestry research and education

UAP has technical collaborative work activities with its NGO clientele, department of environment and natural resources local government units (through their upland development endeavor), academic institutions and other agencies working with agroforestry.

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Kasetsart University

The Faculty of Forestry
Bangkok, Thailand
Choob Kherunark

Introduction

The Faculty of Forestry began as a forestry school in 1936, when the Royal Forest Department opened a ranger training school at Phrae Province, Northern Thailand. There were only five lecturers and the first intake was only 25 students, 17 of whom were from the department itself and 8 were recent high school graduates. The course lasted two years. Since the founding of the Royal Forest Department in 18%, all forest officers had been British and there was a lack of locally trained personnel. The school was set up to overcome the problem. In-service training was later abolished because of lack of qualified staff, and all forestry school students were selected from high school graduates by competitive examination. In 1940, the two-year course was extended to a three-year course giving the qualification Associate in Forestry.

The College of Forestry was affiliated with Kasetsart University in 1944 and offered a five-year course for two years before being suspended due to lack of lecturers and facilities. In 1954, the college moved to its present site at Bangkhen, Bangkok, then in 1957 it again offered a five-year course for the Bachelor of Forestry. The curriculum was reviewed and reduced to four years in 1969.

The first graduate programme in silviculture was offered in 1%7. Later on, other departments also offered their graduate programmes, including the interdisciplinary graduate programme in environmental science.

The PhD programme in forestry science was first offered in 1990 in four disciplines, namely: silviculture, forest ecology, forest resources management and watershed management.

Faculty administration

The faculty now has six departments:, department of forest management, department of forest biology, department of forest products, department of silviculture, department of forest engineering and department of conservation.

The department of conservation is in the process of being divided into three; department of watershed management, department of parks and recreation, and department of wildlife and range science.

The faculty offers a four-year course for BSc in Forestry. The first two years are spent on fundamental science and general forestry under the six departments. In the third year there *is* a choice of majors:

- Forest resources management with eight options: forest management, silviculture, forest biology, forest engineering, watershed management, range management, wildlife management and outdoor recreation
- Forest products
- Social forestry

The Faculty of Forestry is the only academic institution of higher education in its field in Thailand. It is located in Bangkhen, at the same campus as 12 other faculties in an area of 145 ha. Many subjects in sciences, humanities and social sciences are well established in the campus, which also includes library facilities. The total annual intake is 180 (140 male, 40 female) undergraduates and about 100 graduate students. The total current enrollment is about 1000 students.

There are currently 65 academic staff, more than 34 with doctorates and the rest master's degrees in many disciplines. Some newly graduated staff carry bachelor's degrees.

Curriculum development

The new curriculum in social forestry was approved by the university and government authorities for teaching to begin as of 1986. The curriculum development process for the social forestry major started in 1984 with the support of FAO. The work was carried out by a curriculum development committee under an FAO consultant. The present curriculum which aims at training forestry students to cope with the problems of local community development, promoting forest activities that create rural employment and generate income, etc.

History and present status of agrof orestry education

Agroforestry courses were first introduced as electives for undergraduate and graduate students at the department of silviculture in 1976 with the aim to incorporate agroforestry technologies into the reforestation programme to solve land-use conflicts in reforestation schemes in the country. The subjects received good recognition by the concerned organizations responsible for reforestation at different levels. The content of the subjects has been reviewed and developed from time to time to meet the demand of the students and the employees.

The agroforestry courses were under the administration of the department of silviculture until 1992 when the faculty reviewed the administration and decided to transfer the responsibility to the department of forest management. In the very near future there is a plan to establish the new department of social forestry.

At present, there are only three courses offered with the agroforestry name: principles of agroforestry, applied agroforestry, and management of agroforestry. Most of the agroforestry related courses are under social forestry.

Plans for the development of and constraints to agroforestry education

The faculty is preparing to evaluate the present social forestry curriculum, which may lead to future changes. The master's degree programme is also under preparation.

Agroforestry courses are offered under the name social forestry, which requires major courses from other faculties, i.e., faculties of social science, economics, business administration and agriculture. Cooperation among the faculties is quite good. Problems may arise from the major and minor courses that require experts for specific subjects. At present, many of the lecturers do not have direct training in the subjects, but have mostly been learning by doing on the job. We need more qualified staff.

Inventory of teaching materials

The staff concerned have conducted research in the relevant areas to acquire knowledge to teach the subjects. Many textbooks are written in the Thai language for ease of use. Many English textbooks, journals and publications are available at the libraries.

Collaborative activities in agroforestry research and education

Many research projects related to agroforestry have been carried out in collaboration with national and international organizations and institutions. The results are used in teaching and training of local and regional participants whenever needs arise.

The faculty staff are well recognized as resource persons in teaching and training agroforestry in the country.

The university established a new agroforestry research station at Trat Province, Eastern Thailand, in 1992. Most of the forestry and agriculture research stations of the University and other agencies have incorporated agroforestry research in their research programmes because the need has been stressed in farming systems all over the country. Agroforestry receives high attention by policymakers as an important tool to solve land-use conflict.

The faculty established the forestry research centre in 1984 to serve as a coordinating and administering body for all research work relating to forestry and to disseminate the results through the *Thai Forestry Journal*, a quarterly publication, as well as seminars, workshops and conferences.

Agroforestry Research Centre for the Eastern Amazon (CPATU)

Belem, State of Para, Brazil
Gladys Beatriz Martinez

Introduction

The Brazilian Agricultural Research Organization (EMBRAPA) is currently adjusting its regional research programmes according to the real demands from the production systems and the society in general. To make the presence of its research units stronger in the Amazon region, EMBRAPA transformed them into six agroforestry research centres, one for each state of the Amazon region. Thus, in the State of Para, the Agroforestry Research Centre for the Eastern Amazon (CPATU) was created in 1991.

The research programme of CPATU is carried out in Belem (the capital of the State of Para) and in ten research stations located in regions of great social and economic relevance. The centre has ten laboratories covering several areas of basic and applied research. It has more than 600 employees, of which 134 belong to the research staff and the remaining ones to the administrative and technical staff. The research staff has 17% of PhD, 62% of MSc and 21% of BSc holders.

The objectives of CPATU

TECHNICAL

- Generate scientific and technological knowledge for agroforestry and agroindustrial purposes
- Develop and test sustainable agricultural, animal and agroindustrial production systems
- Evaluate the environmental, social and economic impacts caused by the main land-use systems
- Give emphasis to research-development activities in order to improve the utilization of research results
- Conceive and organize programmes and research teams relating to the main problems and/or opportunities of the environmental and social units

INSTITUTIONAL

- Give emphasis to the research-development methodology approach
- Participate in the formulation of agroforestry development, scientific and technological regional policies
- Give support to regional development programmes for the rational use of land resources
- Connect the research and technology dissemination programmes to the regional and state development policies
- Allow the participation of producers and their associated institutions in the formulation and evaluation of the research projects
- Collaborate with the regional, national and overseas institutions that operate in the region

Research programmes/projects

CPATU carries out research in the following areas:

- Characterization and evaluation of agroforestry systems of the Amazon region
- Agroforestry alternatives for reclamation of altered and/or degraded land areas
- Technology of timber agroforestry products
- Sustainable timber production systems in natural forests of the Amazon
- Sustainable timber production systems in cultivated forests of the Amazon
- Development of sustainable production systems for feed crops in the Amazon
- Characterization and evaluation of natural, social and economic resources for rural development
- Environmental alteration from land-use
- Organization of a data bank related to agroforestry

Collaborative activities with the agroforestry education

The availability of land in the Amazon region and the development of extensive animal husbandry resulted in indiscriminate deforestation and, as a conse-

quence, land degradation. In order to overcome this problem, agroforestry systems were incorporated into education curricula and research in the region.

The research of CPATU started collaboration with the Faculty of Agricultural Science of Para (FCAP) in the course of forestry engineering at the undergraduate and graduate levels.

Autonomous University of Yucatan

Faculty of Veterinary Medicine and Animal Science
Management and Conservation of Tropical Natural Resources Programme
Merida, Yucatan, Mexico
Aliza Mizrahi

Introduction

In 1992, the Autonomous University of Yucatan (UADY) established the Programme Protropico*. The programme, based on existing research projects, integrates the efforts of scientists, students and local people, Mexican and international universities, research centres and non-governmental organizations to address complex socioenvironmental problems.

As part of Protropico's agenda, a graduate programme was developed in 1992. The master's programme is structured, supported and based on the infrastructure and related lines of research of Protropico. The master's curriculum will cover two years of full-time studies and will consist of eight courses with three specializations in tropical apiculture, management and conservation of tropical wildlife and agrosilviculture

The staff of the departments of animal science, forestry biological science statistics, apiculture environmental engineering, anthropology and economic will collaborate with the master's programme:

Course outline

The first year will comprise required courses :

- Sample collection techniques
- Social anthropology
- Tropical ecology
- Agriculture and animal husbandry systems: concepts and research methodology
- Agroecology
- Natural resources economics
- Rural sociology
- Experimental design and analysis
- Workshop: Scientific communication, proposal and scientific literature preparation
- Workshop: Evaluation techniques for rural development projects
- Thesis proposal

[4] **Protropico is being supported by the Ford Foundation, McArthur Foundation, Rockefeller Foundation, UNDP-Mexico and Tropical Forest Action Programme-Mexico**

During the second year the student will choose one of the three areas of specialization. The agrosilviculture line will cover courses in principles, concepts and soil usage in agrosilviculture, establishment and management of agroforestry systems, interactions of an agroforestry system and an elective.

All courses have a theory-practice focus and will be given on quarter system with 10 weeks duration. Some of the elective courses are as follows:

- Environmental pollution programme
- Management and conservation of the coastal zone of Mexico
- Tropical silviculture
- Cartography, photo-interpretation and remote sensing as tools for the conservation and management and natural resources
- Ethnoflora
- Ethnoecology
- Issues about the management of plagues

Research projects

The research projects supporting the master programme are the following:

TROPICAL APICULTURE

- *Development of technology with native bees:* Honey production of native bees; propose alternatives to the problems of the africanization of the honey production at home garden level; generate technology for a better utilization of the sting-less bees.
- *Management and utilization of bees in the tropics:* Determine the distribution, abundance and dispersal dynamics of the africanized bee in the Yucatan peninsula in order to propose management alternatives.

AGROSILVICULTURE

- *Agroecology:* Design agroecosystems based on traditional knowledge, and when possible improve the systems with modern techniques that will be ecologically and economically viable, culturally and socially acceptable.
- *Silviculture:* Develop sustainable production alternatives through managing the forest. Apply silvicultural treatments to enrich and improve the state of secondary forests and home gardens.
- *Population plant ecology:* Study the reproductive systems of wild plants, their potential use, the limiting ecological factors of their fecundity. Evaluate their demographic population status, evaluate how the fragmentation of habitats affects the interactions of pollinator-plant with emphasis on the diminution of pollination. Estimate the impact of the introduction of commercial bees into the local bee community and its native flora.

MANAGEMENT AND CONSERVATION OF FAUNA IN THE TROPICS

- *Wildlife in the Yucatan reserves:* register the wildlife diversity in the Yucatan reserves, measure the population of endangered species of economic and ecological importance. Create adequate management and conservation strategies, through productive programmes, so that the people living inside the reserves can benefit economically. Rescue the cultural traditions of the Maya in regards to the management and conservation of wildlife.

- *Ethnoflora of Yucatan:* rescue the usage and management of plant knowledge of Mayan communities in the peninsula with the goal of finding sustainable productive alternatives from this traditional knowledge.
- *Forage potential plants:* Generate information concerning the agronomy of native trees and shrubs with forage potential as well as characterize the nutritional value for ruminants, with the goal of allowing low-income producers to improve their quality of life.
- *Management and use of pesticides:* Evaluate environmental and human health effects caused by the use of agrochemical substances in the agroecosystems.
- *Ecological statistics:* Provide the concepts and statistical methods for the analysis, data collection and model formulation of population and biological communities as well as of the environmental components of the ecosystems.
- *Arthropods of economical interest in the Yucatan peninsula:* Identify the biodiversity of arthropods (insects in particular) present in the region and conserve the material in the form of an entomology collection that will serve as a base for better quality studies.

National University of the Amazon

Faculty of Animal Husbandry
Yurimaguas, Peru
Fernando Araujo

Background

The Faculty of Animal Husbandry of the University of the Amazon (UNAP) is located at Yurimaguas City along River Huallaga in the High Amazon Province, Loreto Region, Peru. Established in 1986, it became operational in 1991. It is a decentralized faculty of UNAP, with headquarters in the city of Iquitos. The faculty includes a professional college with a current enrollment of 120 students.

Curriculum

Initially, our curriculum was entirely based on that of other universities in the country, even though these were mainly dealing with animal science. Our region has a humid tropical climate with infertile acid soils that do not allow intensive agriculture. In order to establish pastures for cattle, the forest has to be destroyed with the resulting ecological degradation. Despite the region having a tradition of cattle rearing, the current situation makes it necessary (imperative) for us to revise the curriculum. The curriculum that we have just developed is much more coherent and will enable us to make a rational use of our resources without destroying the ecosystem. First of all, we have dropped subjects more relevant to veterinarians and animal scientists, and replaced them with subjects such as plant production, vegetable production, agroforestry, agrosilviculture, fish farming, etc.

In other words, our aim is to train specialists in animal production who will be able to manage the ecosystem without destroying *it.* The main idea is to promote the establishment of farms that will use natural resources in a rational and

sustainable way: animal production, vegetable production, fruit production, trees species for timber production and fish farming.

Research and dissemination

National Agricultural Research Institute (INIA) and ICRAF are the two institutions that conduct agroforestry research in Yurimaguas. INIA has been working in the region for more than 20 years and ICRAF has inherited the experience of the work conducted by the University of North Carolina on tropical soils. These institutions have set up experimental plots and conducted training courses and farmers' field days. However, most of the farmers do not have access to information and therefore continue implementing their age-old traditional cultural practices that degrade the environment. Very few technological packages can currently be recommended for direct and immediate implementation.

We have at our disposal a 4029 ha farm where INIA and ICRAF research results will be validated.

Indeed, we have already identified species of forest trees, fruit trees and crops as well as animal strains to be used. The major problem we are facing is with farmers who are very conservative and therefore very reluctant to change their habits and adopt new technologies. Some of them live alongside roads and others on river banks. The land bordering the rivers is very fertile and can be used to plant bananas, rice, maize, cassava, etc., and the farmers refuse to plant any other type of crops. The farmers living alongside the roads plant some crops on small-scale basis and are not ready to wait for the various tree species (either for timber or food production) that grow slowly. In addition, the products from these species do not have readily available markets or processing industries.

Both INIA and ICRAF are making planting material available to the farmers. Some material has already been distributed throughout the area to both small-scale farms and forest plantations.

All research activities conducted so far are of major importance to us. Training courses and farmers' field days organized by INIA and ICRAF are crucial in the dissemination of the various technologies that have to be tested in the farmers' fields.

Our trainees have the opportunity to visit the farmers, exchange their respective experiences and introduce new technologies for later evaluation.

National University of Ucanyali

Peru
Gustavo Horacio Celi

Location

The National University of Ucayali is located in the Peruvian Amazonian Forest, which represents 8% of Peruvian territory (102 517 km^2). It is located at 154 meters above sea level at 08° 22' south latitude, 74° 34' west longitude:

The zone corresponds with the seasonal tropical forest semi-evergreen ecosystem in the Cochrane classification. Predominant soils are ultisols with an acid pH, little availability of organic matter or phosphorus and high Al-saturation.

Establishment and programmes

The university was established in December 1979 and comprises faculties of agricultural science, forestry science, health science and administration and account sciences.

Institutional facts (1993)

Total number of staff:	6
No of teaching staff:	61
Technical and administrative support staff:	5
Total student enrollment	377
Academic year:	April-December
Language of instruction:	Spanish

Table 8. Faculties and students

Faculty	Duration,;years	Annual intake capacity	Total no of students F	M	Total no of students/ faculty
Agriculture Science	5	180	39	134	173
Forestry Science	5	140	25	106	131
Health Science	5	220	181	27	208
Administration	5	880	300	565	865

Curriculum development process history and present status of agroforestry education

The university started its academic function in 1982. One of the courses offered by the agricultural sciences faculty is production systems, which covers, agropastoral system, agroforestry system and agrosilvopastoral themes. In addition, the Faculty of Forestry Sciences also offers a course in agrosilvipastoral system which contains some basic aspects about the agroforestry systems, diagnosis of actual agrosilvipastoral activities, description of traditional agroforestry models, etc.

Every five years the curricula of the two faculties (agriculture and forestry sciences) are reviewed and annually the professors of these courses make modifications in the syllabi, according to the advance of science and technology. As mentioned previously, this is a new programme and has a very limited agroforestry component.

At the moment we have no plans to increase our agroforestry education but we consider that ICRAF's training course on agroforestry systems will improve the agroforestry curriculum. An agroforestry project is being conducted through the forestry research centre of the Faculty of Forestry Sciences,. This project has as an objective to identify the different agroforestry systems in the Ucayali region and to obtain an agroforestry model through them.

In addition, the National University of Ucayali has agreements with national and international institutions related to research and teaching. The university has demonstration plots and laboratories for course practicals, but the major constraint is the deficiency of trained teachers.

We hope that ICRAF and the National University of Ucayali agreement signed last year, will help the further development of the agroforestry education curriculum.

Universidad Nacional Agraria La Molina (UNALM)

Facultad de Ciencias Forestales
Lima, Peru
Maria Isabel Manta Nolasco

General institutional information

The Universidad Nacional Agraria La Molina (UNALM), created in 1902, is located in La Molina, about 11 km from Lima. The UNALM is divided into eight faculties and one graduate school. The faculties are agricultural engineering, agronomy, economy and planning, fishing, food science, forestry, science and zootechnics. The Bachelor of Science degree is obtained after completion of 200 academic credits, and a professional title is conferred after a thesis defense. Each faculty has departments, which are the academic units working mainly on teaching, research and extension.

UNALM is administered by an elected university assembly and the executive authority is the university council. The graduate school, created in 1959, offers MSc degrees in 15 different fields, which will probably be reduced to 10-12 in the near future. The total number of students at UNALM at present is about 4000. There are approximately 400 professors.

The Faculty of Forestry

The Faculty of Forestry has been the cradle and foundation of Peruvian forestry education and research. Science its creation in 1964, it has developed two curricula. The first curriculum has been in force for almost 30 years with courses related to management of forest resources and forest industry. Very recently the Faculty of Forestry approved a new curriculum. This second curriculum programme provides the basis for strengthened practical education, in which the experiences of the last three decades, as well as new national and international policies, market guidelines and environmental requirements have been considered.

History and present status of agroforestry education

Agroforestry education used to be a part of the classic silviculture course, as a system of forest replacement in which plantation of useful trees and agricultural crops were mixed with native forest species. In 1983, with the establishment of the MSc programme in forest science, an agroforestry course was included in the graduate curriculum as an independent course.

At present, the agroforestry course is 60 hours (30 lecture hours and 30 lab hours). The course is shared with professors of the faculties of agronomy and zootechnics. The content of the agroforestry course is presented below.

Development plans for agroforestry education

The most important step for the development of agroforestry education at the Faculty of Forestry of UNALM is training of professors in agroforestry, in order to improve teaching and research. The main alternatives are MSc or PhD studies, research fellowships, or practical intensive field short courses in areas of special interest.

The second step is the development of agroforestry experimental fields, for research activities and demonstration plots, in order to sustain and improve the theoretical and practical foundations of agroforestry.

Constraints to agroforestry education, collaborative activities

The main problem is the lack of trained agroforestry professors at UNALM, as mentioned above. Secondly, the current crisis of the Peruvian institutions, including universities, means extremely poor salaries for professors and scientists, almost no teaching materials, libraries with only few modern books and journals, as well as obsolete technical equipment, and problems in communication and coordination among institutions.

At the end of 1993 ICRAF and UNALM signed a cooperative agreement to develop and strengthen agroforestry education and research.

The agroforestry course at the forest management department

The course in agroforestry covers 3 credits (2 theory hours, 2 practice hours). The objectives of the course are:

- to identify the problems derived from the traditional utilization of the soil
- to guide the current utilization modalities of the soil considering its capacity of use
- to promote the knowledge of associated cultivation developed to prevent land devastation and to support land regular productivity

The course has the following content:

- Introduction to the concepts and agroforestry techniques in Peru
- Importance of the agroforestry
- Advantages and disadvantages
- Scopes of spatial applications of agroforestry systems
- Classification of the agroforestry systems
- Characteristic and planning of use of the soil with agroforestry systems
- Forest species in agroforestry and their use (wood, fuelwood and coal, foods, medicinal)
- Agricultural species in agroforestry
- Analysis of agroforestry ecosystems
- Experiences in management of agroforestry techniques
- Establishment of agroforestry
- Diagnosis and design agroforestry
- Biophysical and socioeconomic monitoring and evaluation
- Future research
- Agroforestry project formulation

Practicals and examination

The theoretical aspects are reinforced with slides and video projection of field experience, and a study trip of 4-5 days to La Genova, San Ramon. The examination is through two theoretical exams and the performance in the practicals and in 2-3 commissioned topics.

Literature used in agroforestry teaching

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Perez C and Suarez M. 1985. *Analysis of agroforestry ecosystems.* Document of work INADE-APODESA no. 7.

Reynel RC and Lion GJ. 1990. *Andean trees and shrubs for agroforestry and conservation.* Lima, Peru: Ministerio de Agricultura.

Mascarenhas J. 1992. *Rural diagnosis and apprenticeship methods - Forest, trees and rural communities.* M15/16.

In addition, ICRAF's multipurpose tree and shrub database, and agroforestry slide series are used in the course.

Annex A —Evaluation

The evaluation showed that the workshop achieved its objectives and fulfilled the expectations of the course participants. The professional as well as the logistical aspects were generally rated between 3.1 and 3.5 on a scale 0-4, where 0 is poor and 4 is excellent. Slightly lower ratings were given to the length of the workshop, since some found it a bit short. The participants gave their view on particular issues according to the following:

- Curriculum development in general:
  There was agreement that DACUM is a useful approach to curriculum development, and that the workshop therefore will have a good impact on curriculum development locally.

- Agroforestry curriculum development/ review:
  The participants appreciated the great usefulness of the DACUM method for initial development and subsequent reviews of agroforestry curricula. Several participants indicated that attempts will be made to improve curricula based on experiences acquired at the workshop.

- Agroforestry education:
  The participants felt that the workshop will have a positive impact on agroforestry education at the home institutions. One participant pointed out that

the workshop gave a better understanding of agroforestry education, and another mentioned that there is a need to create a multidisciplinary approach in agroforesty.

- Linkages/Networking:
  The reaction was that the workshop improved coordination and linkage with ICRAF and other institutions. Some participants from Latin America and West Africa pointed out that the workshop contributed to the regional networks.
- The most fruitful aspects of the workshop:
  Most participants found the introduction to and practice of the DACUM process the most fruitful aspects of the workshop. Several commented on the value of exchanging ideas between the continents. The group work and the way the exercises were conducted were also appreciated.

- Gaps in the programme or sessions that need improvement:
  Some opinions were: That methodology in teaching agroforestry could be included; that the language barrier caused some problems; that a brief overview of other curriculum development methods would have been useful, and that an exchange of agroforestry curricula used in institutions could be used as a basis for improving curricula regionally. Other suggestions were: better time management, clearer exercise instructions, improvement of the DACUM evaluation, and need for a follow-up workshop.

- Overall opinion about the workshop:
  There was a general agreement that the workshop was good to very good, and that it was well planned and implemented. Two participants particularly pointed out the importance of the philosophy of teaching, since most participants are teachers, but without formal education training.

- Achievement of workshop objectives:
  The workshop objectives were fully or almost fully achieved. The concept acquired from the DACUM methodology will be useful not only for agroforestry curricula. One participant felt that the workshop should have more adequately addressed the practical issue of developing curricula for the respective institutions.

- Fulfillment of participants expectations:
  With very few exceptions the participants' expectations were fulfilled. Some comments were that other methods of curriculum development should have been included, and that teaching techniques were missing in the programme. One participant who had previous experiences from a method similar to DACUM found the programme repetitive.

Finally, the participants gave some general comments. One suggested that the DACUM process should be done in full scale in countries offering agroforestry, and another that more teachers should be exposed to DACUM. A Latin American participant asked for a Spanish-speaking person experienced in DACUM. Several also pointed out the need for follow-up locally.

Annex B — Workshop programme

Curriculum development workshop Nakuru 30 May-3 June 1994

	30 May	31 May	1 June	2 June	3 June
8.30-10.00	Opening session 1ntrod uction—AT Opening remarks—EZ Objectives/programme—PR	Morning game drive DACUM process Step 3. Identify process based duties and responsibilities of a position	Course development exercise By regional work groups	Plenary session: Methods for curriculum development in the regions	Action plans—regional/local
10.30-12.30	DACUM Introduction Experiences in the Philippines—STM	DACUM process Step 4. Identify general areas of competence within each position.	Plenary session: Presentation of group output	Consultation/issues on agroforestry curricula	Conclusions/recommendations Evaluation Participants impressions Closing remarks (participant)
14.00-15.30	DACUM process Step 1. Conference orientation	DACUM process Step 5. Arrange into meaningful learning sequence	Plenary session DACUM evaluation	Other aspects on agroforestry education and extension	Return to Nairobi
16.00 - 17.00	DACUM process Step 2. Agree on span of positions	Step 6. Agree on competency profile Summary: Video DACUM presentation	Inventory of methods for curriculum development. in the regions—Regional group work	Evening game drive	

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