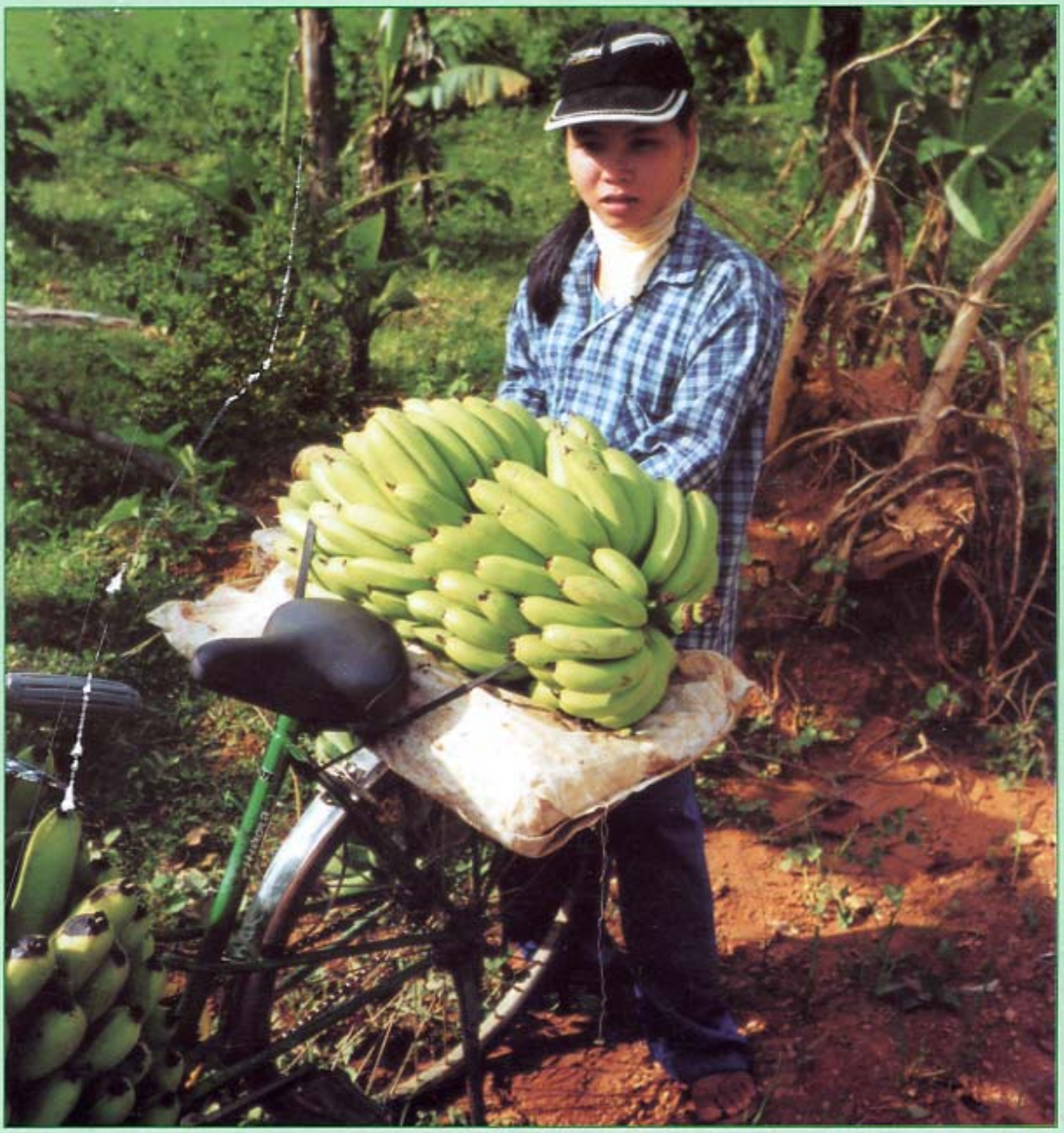
APANews

The Asia-Pacific Agroforestry Newsletter

No. 17, February 2001



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... a newsletter dedicated to agroforestry research, development, education, training and information exchange in the Asia-Pacific region. The newsletter is produced by the Regional Office for Asia and the Pacific of the Food and Agriculture Organization (FAO) of the United Nations to assist the countries in the region in developing sound and sustainable agroforestry practices.

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Cover photograph

Valuable load – bananas from home gardens in Quang Nam province, Central Vietnam (S. Weidner)

Printer

Craftsman Press
Bangkok, Thailand

ISSN: 0859-9742

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Agroforestry research

Local knowledge throws new light on agroforestry research in Asia

By Fergus L. Sinclair

1. Introduction

This article describes some highlights of collaborative agroforestry research in Asia, over the last decade, involving the School of Agricultural and Forest Sciences (SAFS) at the University of Wales, Bangor (UWB). This began with a focus on local knowledge that revealed sophisticated understanding of ecological processes by farmers. This has changed perceptions of what research is relevant to farmers and led to a blend of participatory process-based and systems level research.

2. New ways of knowing

In the early nineties a novel project on indigenous agroforestry knowledge heralded a new era of collaborative research in Asia involving SAFS, UWB. Initially there were collaborators in Nepal (Pakhribas Agricultural Centre), Sri Lanka (the Universities of Peradeniya and Sri Jayawardanapura) and Thailand (the Royal Forest Department and the Chiang Mai University). Six research fellows studied farmers' knowledge across a broad range of agroecological circumstances, focussing on fodder trees in Nepal, Kandy forest gardens in Sri Lanka and miang tea gardens in hill evergreen forest in Thailand. But, before the local knowledge could be understood and used in planning research and extension, appropriate methods of knowledge acquisition had to be created. This led to the development of a knowledge-based systems toolkit and methodology (AKT), in conjunction with the Department of Artificial Intelligence at Edinburgh University. Formal methods of knowledge representation enabled rapid and repeatable knowledge acquisition, increasing both the depth of knowledge obtained from farmers, and the flexibility with which the recorded knowledge could be used to inform research and extension.

3. Farmers' knowledge

Treating farmers' knowledge seriously in this way revealed that they often had a sophisticated understanding of ecological processes. For example, Balaram Thapa, working in Solma village in the eastern mid-hills of Nepal, found that farmers operated a complex trade-off between the fodder value of trees at key times in the season and their competitive effects on crops. Farmers' knowledge of both tree-crop interactions and nutritive value of tree fodders for livestock was detailed and explanatory. His colleague Laxman Joshi (now based at ICRAF in Bogor, Indonesia) went on to generalise this result across Nepal, finding that the conceptual basis of the knowledge system was widespread amongst mid-hill farmers, although details varied according to the extent to which farmers were dependent on particular resources.

Project example 1: Integrating indigenous and biological knowledge to implement improved dry season feeding strategies in the hills of Nepal

In Nepal, over 50% of the population live in the hills and more than 60% of these people live below the poverty line. In the eastern hills, within the command area of the NARC (Nepal Agricultural Research Council) agricultural research station, Pakhribas, almost 70% of farm households are in food deficit for some of the year. Livestock play a pivotal role in hill farming systems, in terms of maintaining soil fertility, providing draught power and producing milk-based products for home consumption and sale. Dry season feed shortages are an enduring problem in smallholder, mixed farming systems. High levels of crop-livestock integration in these systems, means that such shortages constrain not only livestock, but also the productivity of the cropping systems that depend on them. Tree fodder is an important resource, particularly for poorer farmers with small land holdings and only limited access to forest or grazing resources, as it may be produced on crop boundaries or steep hillsides, both unsuitable for arable cropping. On the steeper hillsides occupied by such farmers these may account for half the total land area. The specific objective of this project will be to improve the year-round stability of fodder supplies and thus food security of resource-poor farm families. This will be achieved through integration of farmers' and biological knowledge, through the provision of tools necessary to improve the effectiveness of extension services in supporting the management of existing uses of tree fodder, and through identifying new tree fodder resources and planning dry season feeding strategies in general.

4. Scientific complementarity

Another colleague, Desh Subba, compared farmers' evaluation of the nutritive value of tree fodder with laboratory methods used in animal science. This revealed close correspondence of two independent descriptors of value used by farmers (posilopan and obanopan) with protein supply and overall dry matter digestibility. But there was both complementarity and discrepancy. A major discrepancy was that animal scientists favoured tree fodders with higher digestibility, whereas in times of the season when feed was scarce, farmers valued fodders that satisfied animal appetite

and hence had a lower digestibility. Complementarity was more common, particularly in terms of farmers being better able to describe seasonal variation in nutritive value for a diversity of tree species while scientists understood more about how particular dietary components affected livestock performance. Thus, combining local and scientific knowledge produced a more powerful knowledge base than could have been derived from either source alone. Desh Subba is presently exploring the comparability of local and scientific knowledge in more depth in his PhD research, using participatory on-farm feeding trials.

5. Change in perception

It was immediately apparent that the creation of formal knowledge bases led to profound changes in the perceptions and behaviour of research and extension staff and hence their interactions with farmers. Similar results were obtained in other countries and contexts. After finding that the complexity of Kandy forest gardens rendered their classification into recommendation domains impossible, Gamini Hitinayake in Sri Lanka, found that interventions involving knowledge about components and processes could be effective. For example, whereas attempts by researchers to design more productive garden systems failed, farmers lacked knowledge on specific aspects of garden management such as pruning of timber trees, which if they were taught, allowed them to simultaneously improve timber value and understorey productivity. The key point was to address specific areas of farmers' knowledge, leaving them to integrate this into their complex and heterogeneous systems, depending upon their individual circumstances and priorities. In Thailand, Pornchai Preechapanya found that farmers' understanding of processes of soil erosion in the traditional and sustainable miang tea gardens could be applied to control erosion in new systems where tea was replaced by coffee and erosion was a problem.

6. Change in research methods

Today, a formal evaluation of local knowledge is becoming accepted as a prerequisite for planning appropriate agroforestry research. In Nepal, for example, Thakur Tiwari has begun a crop improvement programme for maize on mid-hill terraces by evaluating farmers' knowledge about local and introduced varieties and how they interact with other components of the farming system. Since farmers intercrop the maize with millet, on terraces where fodder trees ameliorate the atmospheric and soil conditions and feed maize stova to cattle, their criteria for varietal selection are complex. Taking local perceptions into account in selecting germplasm has led to participatory crop improvement that combines yield increases with acceptability to farmers for the first time and prospects for higher yielding varieties being adopted by farmers are good. Furthermore, farmers themselves are co-operating to continue local improvement programmes under their own control. Similarly in Chitwan in the Terai, Dil Serchan, working for a local NGO called LIBIRD (Local Initiatives for Biodiversity Research and Development) began research on the use of green manures in high potential rice cropping systems by evaluating local knowledge. These developments build on pioneering research on participatory approaches to crop improvement in India and Nepal spearheaded by the DFID Plant Science Research Programme based at the Centre of Arid Zone Studies in Bangor.

Project example 2: Participatory crop improvement for maize-millet intercropping in the mid-hills of the Himalayan region

Food deficit and low income are common amongst the hill farmers in the Himalayan region where maize is the most important rain-fed crop. In Nepal, maize is grown on about 0.8 million ha (almost 40% of the total cultivated area of the country) and 80% of this occurs on terraced hill land, producing over 1.3 million tonnes of maize per year. Maize yields currently average just over 1.5 tonnes per hectare in hill regions, less than half of what is regularly achieved with improved varieties on outreach research sites, and they are steadily declining over time. The purpose of this project is to sustainably increase yields from systems on sloping lands by minimising production losses. This will ultimately be achieved by incorporating attributes for higher yield and pest and disease resistance from introduced germplasm into locally acceptable maize varieties that are system compatible. Local knowledge of farmers and their criteria for varietal selection developed in the first year of the project will be harnessed to incorporate system compatible traits from local germplasm with the higher yield potential, and pest and disease resistance, of introduced germplasm in a participatory crop improvement programme. This will produce new varieties of maize and possibly millet which will be both higher yielding under farmer circumstances and adoptable by farmers because they are compatible with the complex farming system and farmer's priorities. New germplasm for farm evaluation will be produced by the end of the project together with an ongoing participatory crop improvement programme that will continue to refine and deliver improved germplasm. Adoption of these new varieties will improve nutrition and increase farm income. There is a demonstrable potential to double maize yield on upper rain-fed (bari) terraced land in Nepal alone in the coming decade, this could increase maize yield in the country by around 750 thousand tonnes.

7. Combining research results with local knowledge

It is important, however, not to romanticise local knowledge. It is clear that there is much that farmers still need to know to improve their livelihoods and there are significant contributions that science can make. For example, several years of research at Agricultural Research Station, Lumle in western Nepal in conjunction with Rita Gardner at the Royal Geographical Society, has revealed much greater nutrient loss through leaching than had been previously thought. Pratap Shreshtra at LIBIRD, in evaluating farmers' knowledge, found that farmers knew a lot about surface

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processes (run-off) but had little or no understanding of leaching. Morag McDonald at Bangor obtained funding for a joint programme involving scientists from both Lumle and LIBIRD to conduct participatory technology development for soil and water conservation in western Nepal that combines scientific experiments with on-farm participatory trials and evaluation of local knowledge. Similarly, at the Rubber Research Institute in Sri Lanka (RRI), Lakshman Rodrigo's ecophysiological PhD research, supervised by Clare Stirling at Bangor, revealed that not only could banana be intercropped with rubber to provide early returns before the rubber trees were tapped, but that rubber yields were also higher under intercropping. Now, further research, involving both evaluation of local knowledge and continued agronomic trials on-station and on-farm, is looking at a wider range of intercropping options and the requirements for effective extension of rubber intercropping technology to improve livelihoods of poor farmers. Rubber is also the subject of research led by ICRAF in Indonesia, where the traditional jungle rubber system that covers over 3 million ha of Sumatra and northern Borneo is important both for the maintenance of rural livelihoods and biodiversity. Bangor's involvement here has been through Laxman Joshi who has taken his experience in developing and applying knowledge-based systems methods from his work in Nepal and applied it, together with socio-economic survey work led by Gede Wibawa at the Indonesian Rubber Research Institute at Sembawa, to understanding farmer decision making. This forms part of a large smallholder rubber improvement programme that also involves agronomic trials and ecological modelling. As with other research, understanding local knowledge and practice has been a central plank of the development strategy. Progress is being made both with introducing higher yielding rubber clones to the system and encouraging gap rejuvenation (locally known and practised by farmers under the name of 'sisipan') as opposed to environmentally destructive slash and burn.

Project example 3: Combining ecological knowledge and socio-economic perspectives in the participatory improvement of multistrata agroforestry systems at the forest margin

Multistrata agroforestry systems are abundant in Asia, Africa and Latin America, often as small intensive land use units managed by women to produce household goods and income but in some areas they are more extensively used for income generation. There is an urgent pressure from resource-poor smallholder farmers in the forest margin to produce more from complex multistrata agroforestry systems to improve their food security and income generation. This is a widespread problem in the tropics affecting a range of plant associations with broadly similar ecological structure (e.g. forest gardens across the tropics, jungle rubber and damar in Indonesia, jungle cacao in Cameroon and Ghana, spice gardens in Sri Lanka and jungle tea in Thailand). Conventional solutions presently available involve conversion of complex agroforests to simple, intensively-managed, 'orchard'-type plantation systems, involving loss of biodiversity and consequent stability and sustainability problems. As an alternative the productivity of these complex agroforests could be sustainably improved by incremental change to current practice, intensifying the multistrata system. To enable this, there is a need to understand farmer decision making, particularly the extent to which their biological understanding is robust and how it is integrated with socioeconomic factors. Through collaborative research on the jungle rubber system in Indonesia, this project will: i) develop efficient generic means to systematically acquire information on decision-making criteria, resources and markets from farmers, and then combine these with ecological knowledge in order to ii) improve the productivity and environmental impact of complex multistrata agroforestry systems and prevent their conversion to monoculture.

Collecting rubber in the forest from SAFS's Web Site

8. Policy

As experience with using local knowledge as a basis for planning agroforestry research and extension accumulates in Asia, the techniques for formal knowledge acquisition are becoming institutionalised. Recently, the Executive Director of the Nepal Agricultural Research Council called for institutional use of local knowledge in research planning while pointing to the need to secure intellectual property rights. New initiatives involving ICRAF, Bangor and a host of local and national collaborating institutions seek to combine local knowledge, experimental research and modelling to empower local communities to manage natural resources more productively and sustainably, and to inform appropriate policy formation that will enable it.

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Agroforestry courses at the University of Wales, Bangor

Prifysgol Cymru - University of Wales
BANGOR

As the leading centre for education and research in agroforestry in the UK with a number of specialist agroforestry academic staff, the University of Wales Bangor (UWB) offers both undergraduate and postgraduate taught courses in agroforestry.

Both B.Sc. and M.Sc. courses are designed to provide an interdisciplinary education in the principles and practice of using land to meet human needs for food, fuel and timber with consideration of ecological, economic and social dimensions and their integration. This involves the consideration of trees, crops, animals and people.

The B.Sc. course runs for three or four years (the four-year course includes a one year placement for work experience). The degree is based on a firm grounding in agricultural, forest and social science and is designed to produce a new generation of graduates who are able to consider the ecological, economic and social complexity necessary to evaluate and improve the land use practices found in the real world, rather than to be hidebound by artificial subject boundaries.

The M.Sc. course is a one-year course designed for holders of B.Sc. level qualifications or their equivalent in the natural sciences, forestry or agriculture. Apart from the aims described above, the course will enable students to develop skills in integrating knowledge across disciplines necessary to evaluate and improve both traditional and novel agroforestry practices. In addition, the course develops skills in critical analysis, creative thinking and individual research initiative required by professional agroforesters. The course has two parts: a formally taught element which runs from September to April, and subsequently a period of approximately five months during which students research a specific area of interest to them and produce a dissertation.

For further information, please contact the relevant Course Director:

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Agroforestry development

Aspects of agroforestry in the Sino-German Afforestation and Nature Conservation Project, Sichuan province, China

By Ian Armitage

Photo 1: Barren mountains, Chaotian district I. Armitage

1. Introduction

The Sino-German Afforestation and Nature Conservation Project was inspired by concern amongst Chinese officials about declining agricultural productivity, the widespread use of unsustainable agricultural practices and increasing poverty amongst village communities in the northern mountains of Sichuan province, China. The cause of these trends is increasingly severe degradation of land ecosystems. The most widespread and obvious effects of environmental deterioration are extensive and serious erosion, periodic and often severe flooding and sedimentation of rivers.

The Sino-German Afforestation and Nature Conservation Project is funded under a programme of German financial co-operation with China by Kreditanstalt fuer Wiederaufbau (KfW) of Frankfurt. It is being implemented by the Sichuan Forestry Department with technical assistance provided by a consortium of German consultants (GITEC Consult GmbH, Duesseldorf, and Deutsche Forstservice GmbH, Feldkirchen). The project commenced in 1998 and operational work will continue until 2002.

2. Characteristics of the location in Sichuan province

The project is located in Guangyuan prefecture in the northern part of Sichuan province, a generally mountainous region bordering onto Shaanxi and Gansu provinces in western China. It is a part of the Yangtze River Shelterbelt Protection Programme within the upper catchment of the Jialing river, a major tributary of the Yangtze river. There has been considerable deforestation of the natural forests during the 20th Century and now a large rural population is heavily dependent upon agriculture for food production, mainly for cropping, and often on quite steep slopes. Periodic heavy rain on steep slopes (see Photo 1), mostly in summer, leads to rapid water runoff and flooding. Droughts often occur in spring, a severely limiting factor for agriculture and for community forestry, both being critically important to the rural communities living in Guangyuan prefecture.

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Landforms vary from rolling hills in the south to high and steep mountains, up to 3,500 m altitude, in the north. Yellow brown and purple soils of moderate to low fertility occur, all being prone to erosion (see Photo 2).

Photo 2: Eroding hillside, Shizhong district I. Armitage

The buffer zone edge of the Tangjiahe National Nature Reserve is included in the project area. It is a mountainous spruce/fir forest that is an important habitat for giant panda, lesser panda, golden monkey and other endangered animals. Losses experienced by farmers living close to the reserve boundary caused by wildlife that feed on their corn and other crops is a cause of local poverty amongst many local families.

3. Project goal and activities

The ecological fragility of much of the land, linked to poverty amongst local communities, led to the definition of a project goal that focuses on the stabilisation and rehabilitation of land ecosystems, to the improvement of local people's income and poverty alleviation and to the establishment and sustainable management of both protection and production forests that may be harvested by them in the future.

Three main sets of activities are being implemented:

- To contribute to the sustainable management of approximately 45,000 ha of newly planted and enriched, mixed species, broad-leaved conifer forests under the active participation of local communities. Afforestation includes new planting of bare land and "mountain closure" of land where some natural vegetation is already established.
- To contribute to the reduction of damage to farmers' crops that is caused by wildlife in the vicinity of the Tangjiahe National Nature Reserve.
- Installation of 10,000 energy-saving stoves to poor rural households to improve the efficiency of use of wood and agricultural wastes for cooking, thereby reducing the demand for fuelwood that is collected from hillsides.

4. The active participation of farmers is encouraged

The project aims to be a model in Sichuan province for high quality afforestation. It is being implemented as an "open programme", meaning that the detailed planning of where and when afforestation and mountain closure activities will be implemented may be modified during project implementation in close co-operation and in consultation with the local communities who have chosen to participate (see Photo 3). This approach is being applied in order to avoid land-use conflicts, for example, over the use of land for grazing of livestock and for the collection of fuelwood for cooking. These uses have traditionally caused some damage to mountain forests and shrublands.

Photo 3: Participatory planning I. Armitage

Detailed planning takes place each year as the project is implemented and the active involvement of the households who are associated with it is encouraged. An important aim is to avoid land-use conflicts and to involve individual farmers in detailed project design and in implementation. Land-use planning is a prerequisite of the project that needs to be met by communities who show a willingness to participate in the project before operational work can be carried out. Once general agreement has been reached on the need for and the extent of afforestation or mountain closure for a community by following the participatory land-use planning process, then afforestation contracts for specific activities are able to be negotiated with individual farmers.

5. Afforestation categories

An underlying theme is the restoration of forest landscapes through the establishment of mixed-species protection/wood production forests involving tree species that are ecologically appropriate for the range of sites that occur in the mountains of Guangyuan prefecture. A feature of project design is the establishment of a diversity of tree species, both conifer and broad-leaved species, where at least 30 percent of broad-leaved species are planted. Mixed-species forests must consist of at least two species, none having a share less than 30 percent by area. If three species are planted, none must have a share of less than 20 percent by area, and where more

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than three species are planted none must have a share of less than 10 percent by area. Four afforestation categories are applied – protection/wood production, mountain closure without enrichment planting, mountain closure with enrichment planting and "economic" treecrops. The choice of category depends upon the ecological features of each site and of the amount on shrubby or low forest vegetation that may already be growing.

It is hoped that the long-term effect of this approach will be to strengthen the basis for establishing ecologically sustainable forests that are beneficial for soil and water conservation and for the production of limited amounts of wood for use and for sale by farmers. It is expected that populations of birds and other wildlife will also increase.

6. Afforestation models

Several afforestation models have been defined from which farmers can make choices of the trees that may be planted. The most widely planted include cypresses (*Cupressus funebris*, *C. lusitanica*, *C. torulosa*), alder (*Alnus cremastogyne*; see Photo 5), mason pine (*Pinus massoniana*), birch (*Betula luminifera*) and Chinese fir (*Cunninghamia lanceolata*).

Photo 4: One-year old alder I. Armitage

A small though popular part of the project is based on "economic" treecrops that produce saleable fruit, nuts or medicinal plants rather than wood. The major species are chestnut (*Castanea mollissima*), walnut (*Juglans regia*) and gingko (*Gingko biloba*).

7. Important features of forest establishment practices

An essential and indeed critically important aspect of the programme is achieving high treestock survivals. All operational work is pre-financed by the Sichuan Forestry Department; financial reimbursement follows by the donor based on specified establishment criteria being met. Project design requires that financial reimbursement for afforestation be made in two stages based in large part upon the average treestock survival in each stand that has been planted. Average treestock survivals for each stand must reach or exceed 85 percent after six months for the first reimbursement and must reach or exceed 70 percent after three years to qualify for the second financial reimbursement.

There are five important features of forest establishment practices that are important in achieving high treestocks survivals. These are:

- Avoid ecological mismatching of tree species to sites.
  A vital aspect of participatory planning is that farmers' choices of tree species are ecologically appropriate for specific sites and that ecological mismatching of species to sites does not occur. Ecological mismatching of species to sites invariably leads to low treestock survivals and to poor stand performance.
- Efficient forest establishment.
  Forest establishment must be undertaken efficiently with the aim of ensuring high quality tree planting in order to achieve, or exceed, 85 percent survival on the first planting.
- Deep and firm planting of trees.
  Farmers are encouraged to practice deep cultivation of soils in each position where trees are being planted and to firmly plant each tree at each planting position, using their boot/shoes to carefully "firm" the soil around each tree. Both practices are important because they will increase the likelihood of achieving acceptable levels of tree survivals.
- Use of container-grown conifer treestocks.
  The use of container-grown pine and cypress treestocks is now standard practice because it contributes significantly to achieving high treecrop survivals. The use of container-grown treestocks reduces planting shock when trees are transplanted and effectively protects root systems from the drying effects of the sun and wind.
- Care in treestock handling.
  Improved protection of bare-rooted treestocks that are being transported between nurseries and planting sites has led to reduced root damage from the drying effects of sun and wind. Covering roots of bundled treestocks with soil and "mud puddling" to protect root systems soon after lifting is encouraged to protect root systems.

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Agroforestry development

Commercial agroforestry investment schemes in India

Success or failure in the context of the rural economy

By Kulbhushan Balooni

1. Introduction

In recent years, the concept of agroforestry in India has undergone radical changes. Of late, new models of commercial agroforestry have evolved in the country creating a number of new investment opportunities for the general public. These new large-scale commercial schemes have grown dramatically, generating a high degree of interest amongst investors.

Several companies have successfully attracted substantial private capital investment in agroforestry and tree plantations. This approach started with eucalyptus in Northern India in the mid-1980s and has been followed by teak plantations in Southern India, starting in the early 1990s.

Initially, these schemes involved only monoculture plantations, but were later followed by modified versions of tree plantation schemes influenced by agroforestry approaches. These so-called "commercial agroforestry investment schemes" attracted investors with promises of high returns, tax-free agricultural income after a certain maturity period, and in some cases intermediate income. For example, SK Agro Enterprises promised to double a Rs 20,000 (1 US Dollar = 26.15 Indian Rupees in December 1992) investment in vegetable cultivation near Gurgaon in the State of Haryana in only 30 months (Press Trust of India, 12 December 1992).

The agroforestry-type investment schemes offered to the public included vegetables and other horticultural crops planted along with teak, rosewood, and many other valuable tree species. In some cases, the schemes included flowers and herbal plants. Some schemes allowed investors to buy a piece of land for a stipulated price, after which the companies intended to plant vegetables and fruit trees. Not least, the companies charged a development fee from the investors for acquiring and developing the land.

The promoters of these plantation schemes continue to speak highly of the new production systems – some of which are quite similar to the traditional agroforests and orchards widely spread throughout India. They are therefore also promoted as ameliorating the environment and providing various important produce.

For example, Imperial Farmers Forestry Corporation Limited (Ltd.), while inviting investments from the public for its forestry and agriculture projects in 1994, proclaimed that it had successfully invested in seasonal crops, cash crops, fish, poultry, sheep and goats (Sunday Mail, 20 November 1994). Furthermore, the company raised hopes of generating employment for more than 10,000 people through its agroforestry program.

Parasrampurias, a 125-year-old business house in India with an annual turnover of Rs 4,000 million, started a Rs 50 million (1 US Dollar = 31.37 Indian Rupees in March 1993) capital-based company, Parasrampuria Plantations Ltd., in 1993 to promote agroforestry (Free Press Journal, 20 May 1993). Trees planted by this company were to be maintained by the Agro Forestry Federation, the apex body of a tree growers' cooperative in the State of Maharashtra, which claims to have vast experience in raising tree plantations on a large scale (Khungar, 1993).

2. Traditional vs. commercial agroforestry

There are numerous definitions for the term "agroforestry". Bene et al. (1977) have defined agroforestry as a "sustainable management system for land that increases total production, combines agricultural crops, tree crops and forest plants and/or animals simultaneously or sequentially and applies management practices that are compatible with cultural patterns of the local population". If this definition is compared with above description of commercial agroforestry investment schemes in India, it becomes obvious that two very important components are missing in the latter: animals and a decisive role for the local population. Moreover, the agricultural crops and timber of commercial agroforestry investment schemes are produced for cash, while traditionally farmers have grown trees and crops and raised animals mainly for meeting subsistence needs. This practice of mixed farming has developed over centuries in response to specific agroecological and socioeconomic circumstances.

Agroforestry systems in the "narrow sense" have several tangible and intangible advantages – they provide food, fodder, construction material, medicinal plants, income and employment opportunities, environmental benefits, and shelter for wild animals. There is no doubt that some of these benefits, especially intangible ones, could also be generated by commercial agroforestry investment schemes. Those benefits that are important in the context of the rural economy (e.g., farm income, employment), however, do not play a major role in the new concept of commercial agroforestry. In many cases, the income generated by selling the products of commercial agroforestry investment schemes is mainly distributed amongst urban investors and promoters.

According to Dwivedi (1992), commercial agroforestry investment schemes are usually managed by private companies, corporate bodies or government institutions. Examples of such schemes include tea, coffee and cocoa under shade trees, and eucalyptus plantations for pulp and paper on agricultural land in combination with agricultural crops.

Agroforestry development

Recently, forest-based industries have started to collaborate with farmers to grow timber on their agricultural land. This has been done to meet the demand for raw material due to dwindling supplies from government-owned forests and plantations. For example, Western India Match Company Ltd. has already entered into arrangements with farmers by providing financial and technical assistance for establishing and maintaining timber plantations on private land with assured returns to farmers. Burley (2000) has highlighted the emergence of this new trend in India during the 1990s, referring to industrial plantations that are increasingly attracting rural communities and individuals as out-growers to centralized industries.

At the same time, under the government-promoted farm forestry programs of the late 1970s and early 1980s, farmers took an interest in converting their land into (fast-growing) tree plantations for making quick returns. However, in contrast to commercial agroforestry investment schemes, farmers were directly involved in the tree-growing businesses.

Overall, it appears that using the term "agroforestry" in the context of financial ventures such as the new commercial investment schemes in India may be misleading.

3. Implications of Commercial AF Investment Schemes

Commercial agroforestry investment schemes can be found in the far-flung rural areas and, in some cases, in the rural areas near to cities. The agricultural land that is targeted for these schemes is often cultivable wastelands lying unused due to a lack of irrigation. They are therefore easily transferable to the investors (Manjeshwar, 9 September 1993), who either purchase the land or take it over under long-term leases. In some cases, investors manage to acquire fertile land which is sold by absentee owners or poor farmers working as laborers elsewhere.

The companies promoting these commercial investment schemes acquire the land directly from their owners or through agents. If agents are involved, the original land owners usually do not receive an appropriate compensation for their land. To entice poor farmers to sell their land, agents guarantee them permanent employment within the investment scheme. In the end, however, these farmers are often left unemployed.

An additional concern is whether or not the laborers working in the plantations are paid legal wages as per the norms set up by the concerned State Governments. Singh (1996) investigated the socioeconomic impact of plantations run by Maxworth Orchards (I) Ltd. in six villages in Raigad district, State of Maharashtra. This study revealed that laborers were paid low wages and those who sold their land to the company were not sufficiently compensated. The author also found that Maxworth was frequently confronted with strikes of their laborers. According to Nair (1979), agroforestry is "a land use system that integrates trees, crops and animals in a way that is scientifically sound, ecologically desirable, practically feasible, and socially acceptable to the farmers". As regards the latter criterion, however, given the example of Maxworth Orchards (I) Ltd., the commercial agroforestry investment schemes of India seem not always to be socially acceptable.

There are various factors constraining farm production in India, including degraded natural resources, lack of agricultural inputs, and lackadaisical attitudes of authorities. These factors will continue to drive rural people to migrate to cities in search of off-farm employment, thus contributing to a further expansion of urban centers and an increase in socioeconomic problems. The growth of companies involved in the current forms of commercial agroforestry investment schemes may actually exacerbate this problem.

4. Government interventions and status quo

Many promoters of commercial agroforestry promised that their schemes would generate employment for a large segment of the rural population. The plantations would also contribute to the rehabilitation of wastelands lying unused for years. In addition, they promised to increase the overall agricultural production in the country.

However, growing skepticism about the functioning of commercial agroforestry and other plantation investment schemes necessitated the Government of India to intervene. In November 1997, a decision was made to put all investment schemes under the provision of the Securities and Exchange Board of India (SEBI) Act of 1992. As a consequence, they are to be treated as so-called "collective investment schemes"

Subsequently, all collective investment schemes were notified to file the details of their operations and apply for a certificate of registration. However, by 31 March 2000, only 37 such entities had applied for registration. A further 605 entities, which failed to make an application, were notified to close their schemes. At the same time, they were also given orders to make payment to their investors by 28 May 2000, failing which these companies were to face legal action by the Government.

One example of the serious legal action taken is the case of Golden Forests (I) Limited, Chandigarh. In 1998, SEBI filed a petition against this company, seeking to freeze its assets on grounds that it had collected a large sum of money from the public but had defaulted on promised returns. The company was brought to the High Court and directed to expeditiously sell off its assets worth Rs 4,500 million (1 US Dollar = 43.35 Indian Rupees in February 2000) in order to pay debts owed to investors (Economic Times, 21 February 2000).

Moreover, on the orders of SEBI, the remaining 37 collective investment schemes were to be rated by independent rating agencies. As a result, 34 schemes were classified to be risky investments as they appeared likely to default on their pay-out commitments (Aiyer, 2 November 1998).

As might be expected, these developments heavily affected the commercial agroforestry investment schemes since investors became reluctant to invest in such schemes. The time seems right to re-examine alternatives for developing commercial agroforestry in the context of the rural economy.

Agroforestry development

An interesting finding is that 247 out of 605 collective investment schemes that had been ordered closed were operationally based in five major cities (Mumbai, New Delhi, Chennai, Hyderabad and Chandigarh). All these cities have a large proportion of middle-class households, which made up the main group of investors of collective investment schemes. This suggests that, in spite of their rural setup, these schemes were primarily established to attract urban capital and maximize the profit of urban promoters. The actual interests of farmers in the rural areas of India remained largely unconsidered.

5. Conclusions

The experiences from India have shown that caution is required in the assessment of commercial agroforestry investment schemes. The major beneficiaries are urban investors and promoters, certainly not rural people. Unlawful business practices by, and poor performance of, commercial agroforestry and other plantation investment schemes led to Government interventions resulting in the closing of almost all schemes. Nevertheless, some of the commercial agroforestry investment schemes, after meeting extensive Government requirements, continue to operate in India. Efforts are necessary to further study their development, their impacts (particularly on the grassroots levels), and their potential for boosting the rural economy by generating required capital.

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Editorial note:

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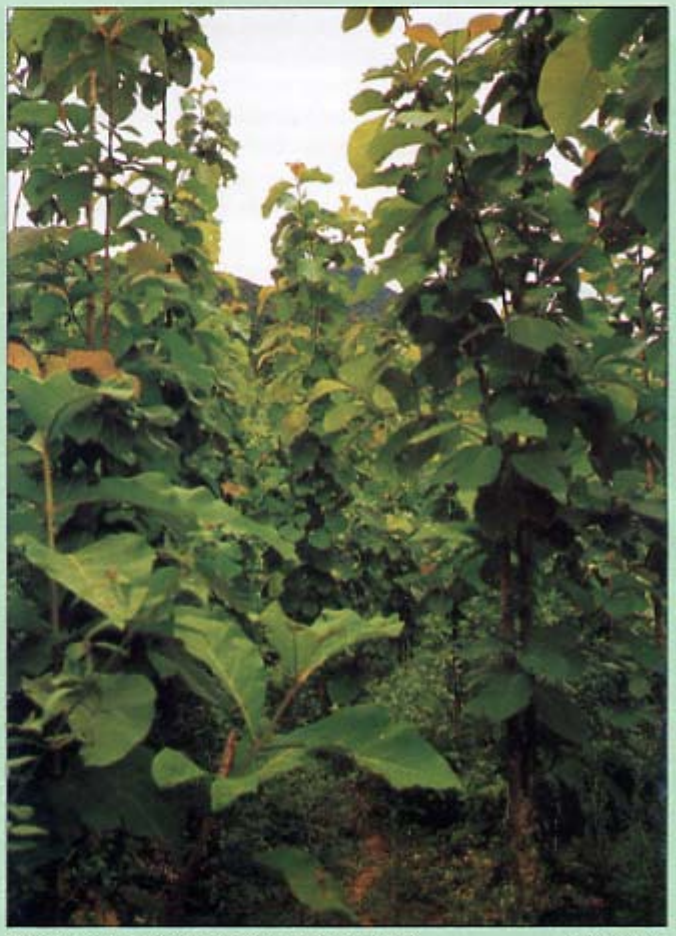

Small-scale teak plantation on farm land S. Weidner

Agroforestry education and training

Study on the demand and placement of agroforestry graduates in the Philippines

By Leah P. Arboleda

1. Introduction

From May to July 2000, the Institute of Agroforestry (IAF) of the University of the Philippines Los Baños conducted a "Study on the Demand and Placement of Agroforestry Graduates in the Philippines". The study, sponsored by the Southeast Asian Network for Agroforestry Education (SEANAFE), was conceptualized to examine and evaluate the long-term development of agroforestry education in the Philippines. The issues addressed included the proliferation of agroforestry education programs, the preparation of graduates for future employment in agroforestry, and the minimum standards used in agroforestry education. These standards determine the relevance of agroforestry curricula and the quality of agroforestry graduates being trained. At the same time, the outlook for agroforestry education in the future was analyzed.

Agroforestry training at UP Los Baños S. Weidner

2. Findings of the study

Presently, there are at least 31 schools offering six different agroforestry education programs. The programs lead to the following degrees:

- Bachelor of Science (Agroforestry)
- Bachelor of Science (Agriculture) with a major in Agroforestry
- Bachelor of Science (Forestry) with a major in Agroforestry
- Bachelor in Agroforestry Technology
- Bachelor of Science (Agroforestry Entrepreneurship)
- Bachelor in Agroforestry Entrepreneurship

The study analyzed the motivational factors of schools to offer these programs, agroforestry skills and competencies desired by employers, first jobs assigned to agroforestry graduates, the relative match of skills and competencies acquired by graduates with those expected by employers, and the final placement of agroforestry graduates. The study also elicited recommendations on how to ensure the quality of agroforestry education in the country. Data and information for the study were generated by surveying agroforestry graduates and their existing and potential employers.

Initial results show that the number of agroforestry schools and related educational programs are increasing. New agroforestry programs are being developed because of the increasing demand for agroforestry graduates. Although some agroforestry schools are still using the existing minimum standards stipulated in the Ministry of Education, Culture and Sports Order No. 4, Series of 1981, as reference in curriculum development, many schools view agroforestry as a distinct educational field that covers more than agriculture or forestry alone. They also believe that agroforestry education should be professionalized to produce more competitive graduates.

The study revealed that most of the students choose agroforestry because they are interested in this subject. Furthermore, it was found that most of the graduates of agroforestry schools and programs become employees while a minority chooses self-employment or remains unemployed. The study showed that the Philippine Department of Environment and Natural Resources (DENR) is the major employer of young agroforesters, followed by NGOs, Local Government Units, academic institutions and the Department of Agriculture. Other graduates are hired by private institutions. Self-employment becomes an option in areas where agroforestry is considered a profitable business.

On the part of employers, agroforestry graduates are needed most to plan, implement and maintain development projects. In this context, the most preferred candidates are graduates holding a B.Sc. degree in agroforestry, followed by those holding a B.Sc. degree in agriculture or a B.Sc. in forestry, both of which combined with a major in agroforestry. The employers stated that they expect agroforestry graduates to be able to integrate forestry practices with approaches in crop production and stock raising; to plan, implement, monitor and evaluate agroforestry projects; and to undertake research and technology development. Additional areas of expertise that agroforestry graduates are expected to be familiar with include problem analysis, community planning, community resource management, land-use planning, soil and water conservation, and communication.

Agroforestry education and training

Initial results indicate that agroforestry graduates are often assigned tasks related to community organization and development; planning, implementing, monitoring and evaluating of agroforestry projects; nursery and plantation establishment and management; soil and water management, pest management, and biodiversity conservation; advocacy of agroforestry and related fields; and lecturer or trainer in agroforestry programs.

However, the study also revealed that the skills and competencies of agroforestry graduates are generally insufficiently developed in the areas of research and technology development, surveying and mapping, analysis and design of agroforestry projects, community organization and development, development of income-generating activities, communication, and extension.

The results of the study will be used to formulate guidelines for agroforestry curriculum development, assess the current supply and demand for agroforestry professionals, and formulate policies that lead to demand-driven education and training of agroforesters in the Philippines. Not least, the results of the study were used to guide the development of a curriculum framework for the B.Sc. degree in agroforestry during the "National Workshop on Participatory Agroforestry Curriculum Development" (see article below) convened at Rizal State College, Tanay, Rizal, from 29 August – 2 September, 2000.

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Philippines: Curriculum for B.Sc. (Agroforestry) developed

By Leah P. Arboleda

A "National Workshop on Participatory Agroforestry Curriculum Development" was convened at Rizal State College, Tanay, Rizal, Philippines, from 29 August - 2 September 2000, to formulate guiding principles and strategies to ensure the quality of agroforestry education in the country and the placement of agroforestry graduates. The workshop was facilitated by the Institute of Agroforestry (IAF) of the University of the Philippines Los Baños (UPLB) and financially supported by the Southeast Asian Network for Agroforestry Education (SEANAFE). Participants included representatives of agroforestry schools, the Commission on Higher Education (CHED), the Department of Environment and Natural Resources (DENR), local government units, and several agroforestry graduates.

The participants of the workshop jointly developed, and recommended formal adoption of, an agroforestry curriculum framework to guide agroforestry schools in the country to improve their education programs. Agroforestry became the main land-use option in community-based forest management and for Ancestral Domain areas resulting in an increased demand for highly qualified agroforesters. Although, since the first B.Sc. degree program in agroforestry was introduced in the Philippines in 1976, the number of agroforestry education programs has significantly increased, the quality of agroforestry training could not keep pace with this development.

The agroforestry curriculum framework developed during the workshop was specifically designed for the B.Sc. degree program in agroforestry. Workshop participants agreed about this program having the highest potential for creating required competencies and ensuring the placement of agroforestry graduates.

The agroforestry curriculum framework describes the training courses that should be included in a B.Sc. (Agroforestry) degree program to meet the qualification needs of future agroforesters. Among the major courses recommended by the workshop participants are Community Organization, Planning, Management and Evaluation of Agroforestry Projects, Agroforestry Production and Post-production Technologies, Soil and Water Conservation, Enterprise Development and Management, Supportive Technologies and Income-generating Projects, and Communication and Extension. Furthermore, the framework encourages students to consider complementary subjects such as Geographical Information Systems, Environmental Impact Assessment, Sustainable and Ecological Agriculture, Multiple Cropping, and Aquaculture.

During the workshop, participants suggested the establishment of a "Committee on Agroforestry" as one of the technical committees of the CHED Technical Panel for Agriculture Education. They also recommended that procedures to be followed by schools to obtain permission to offer new agroforestry education programs be formally regulated. Moreover, workshop participants recommended the establishment of a Philippine Agroforestry Education and Research Network (PAFERN). The network would serve as an informal association of agroforestry schools and training institutions in the country. It is hoped that PAFERN would lead to closer linkages among the partners of the network and contribute to improving agroforestry education in the Philippines.

At the close of the workshop, a "Resolution on Agroforestry Education in the Philippines" was drafted and signed by all participants. This resolution contains all recommendations elaborated during the one-week workshop. Meanwhile, the resolution was endorsed by the Philippine Association of State Universities and Colleges and submitted to CHED. It is expected that the constraints currently facing agroforestry education in the country will be addressed in the near future.

Agroforestry education and training

Agroforestry training 2001 at UP Los Baños

As in previous years, also in the year 2001, the Institute of Agroforestry (IAF) at the University of the Philippines Los Baños (UPLB) will offer its widely known agroforestry training courses.

UPLB's agroforestry laboratory S. Weidner

The IAF Agroforestry Courses will be given during the following periods:

Agroforestry Project Planning and Management:
18 – 24 March, 2001

Integrated Pest Management (IPM) for Agroforest Farms:
22 – 28 April, 2001

Agroforestry Seed Technology and Nursery Management:
20 May – 2 June, 2001

Soil and Water Conservation and Management for Agroforest Farms: 24 June – 7 July, 2001

Agroforestry Technology Verification through On-Farm Trials: 22 – 28 July, 2001

Agroforestry Production and Post-Production Systems:
19 August – 8 September, 2001

Sustainable Agriculture Initiatives for the People:
30 September – 6 October, 2001

Participation is open to managers of development projects, technical field personnel, researchers, trainers, community leaders and other interested persons from governmental and non-governmental organizations, local government units, people's organizations, academic and research institutions, and other concerned local and international institutions.

A registration fee is charged for each participant to cover the costs of food, accommodation, training materials, local travel and insurance during the training period.

Upon request, these regular courses can also be offered on-site. Special training courses are also developed and implemented to address capability building needs of technical personnel of local and international institutions working in agroforestry and related fields. IAF also arranges educational study tours for foreign participants to provide them with an overview on how agroforestry is practiced in the Philippines. To arrange on-site and special courses and study tours, please get in direct contact with IAF.

Conservation of medicinal plants at UPLB S. Weidner

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Web sites recommended by *APANews*

MekongInfo – Information on natural resources management in the Lower Mekong Basin

http://www.mekonginfo.org

MekongInfo at http://www.mekonginfo.org is an interactive Web-based system for sharing information and knowledge about natural resources management, with a focus on forestry, in Cambodia, Laos, Thailand and Vietnam. This Internet site contains six linked modules (Library, Reference, Case Studies, Announcements, Contacts) with Vietnamese, Khmer, Thai and English language versions.

Index site of MekongInfo

MekongInfo aims to support actors in the region to share their experiences, and to promote the emergence of sectoral information and knowledge networks. Moreover, MekongInfo provides a range of free information services related to natural resources management, including:

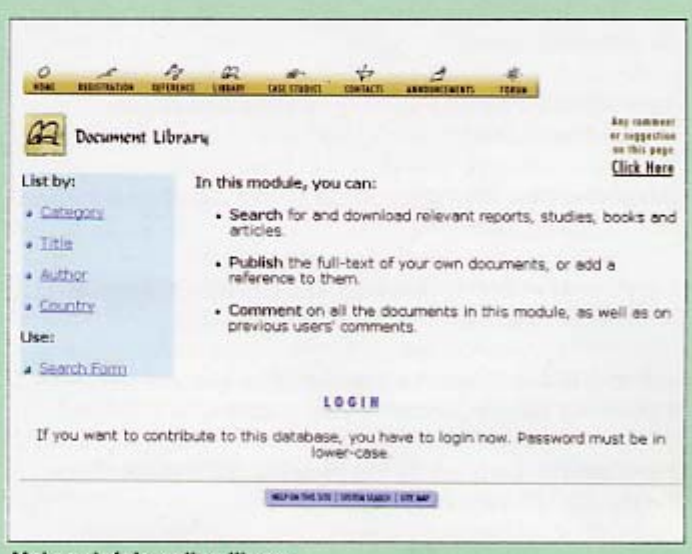
- A virtual library with reports, case studies and "grey" project literature, many of which are not available in libraries or on the Internet;
- Web hosting services;
- News and announcements about upcoming events;
- A gallery presenting new publications and resource materials;
- A forum for online discussions on different themes; and
- CD-ROMs, e-mail updates, and hard-copy reports.

MekongInfo was developed by the Sustainable Management of Resources in the Lower Mekong Basin Project (SMRP), a technical cooperation project between the Mekong River Commission and Germany. SMRP supports the generation, exchange and dissemination of information and experiences related to forest management in upland watersheds.

The information system runs as a "prototype" so that it can be improved in response to the users' needs. Registration is free-of-charge, and enables users to publish their own documents online, comment on existing documents, post news and announcements, etc.

MekongInfo is based on a partnership approach that seeks to build capacity of selected local organizations to maintain and manage the system. Support is given to create MekongInfo nodes, which train future providers, custodians and managers of information, and contribute to the growth of a regional network for information exchange related to natural resources management.

MekongInfo's online library is growing continuously. So far, it contains more than 2,000 relevant case studies, books, reference materials and "grey" project reports. Documents are available in full-text or abstract. The library is searchable by country, subject, author, key words, etc.



MekongInfo's online library

For further information, or to receive a free MekongInfo CD-ROM, please contact:

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Tel./Fax: 84.4.9346002
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Web sites recommended by *APANews*

The Forest Garden Program – Reforestation of degraded land through family-owned forest gardens

http://www.forestgarden.org

In October 1997, through a collaboration between the NeoSynthesis Research Centre (Mirahawatte, Sri Lanka), Counterpart International, Inc. (Washington, D.C., USA), and Counterpart Philippines (Cebu City, Philippines), the Forest Garden Initiative was launched. Supported by a five-year matching grant from the United States Agency for International Development, this program is developing and perfecting a flexible model silvicultural system that fosters the restoration of degraded land through the development of family-owned forest gardens by rural agriculturalists around the world. The Forest Garden Initiative offers farmers a new organic and environmentally-friendly farming system that increases their income while at the same time encouraging development of permaculture plantings that increase green canopy cover, promote biodiversity, and reduce local erosion.

The Forest Garden Initiative seeks to:

- Promote re-vegetation on deforested and degraded lands;
- Increase local prosperity;
- Increase local biodiversity;
- Increase environmental sustainability;
- Improve local land management and reduce erosion;
- Improve local living conditions;
- Locally stabilize or reverse the trend toward deforestation;
- Shift farming from chemical-intensive annual crops to woody perennials grown organically; and
- Foster a robust, value-added global market for Forest Garden products.

The Forest Garden concept is an on-the-ground adaptation of the formal management system known as "analog forestry". This system has been based on proven methodologies developed over decades by traditional forest gardeners in the tropics and the principles of modern biological and ecological sciences. It also includes innovations and improvements developed experimentally over fifteen years at the NeoSynthesis Research Centre in Sri Lanka. These ideas are now being implemented in dozens of communities in Sri Lanka, and is being introduced in the Philippines, Mexico, Ecuador, Costa Rica, Peru, Australia, and Canada.

Homepage of the Forest Garden Program

The Forest Garden technology is appropriate for a range of environments and can benefit rural communities in scores of emerging nations. If you want to join the Forest Garden network and learn, participate, and contribute to this initiative, you should visit the Forest Garden site in the Internet at http://www.forestgarden.org.

The ICRAF 'Agroforestree' database

http://www.icraf.cgiar.org/treessd/AFT/AFT.htm

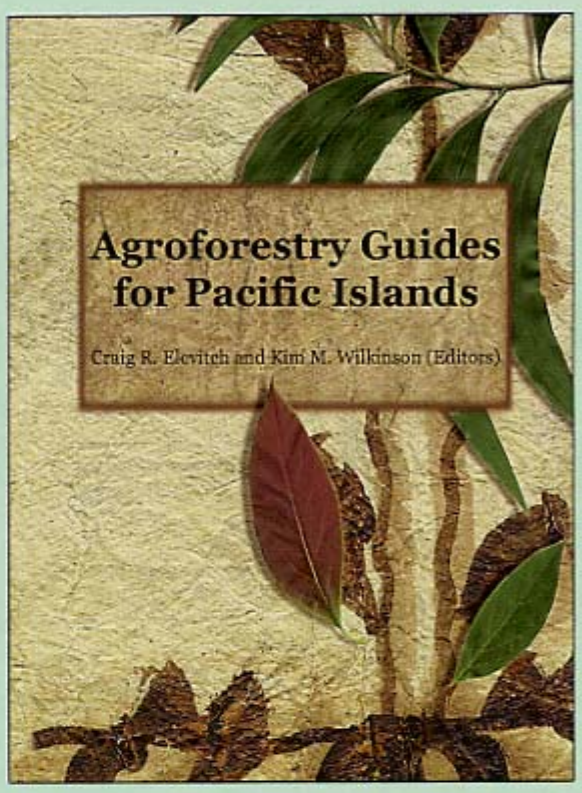
Internet site of ICRAF's 'Agroforestree' database

ICRAF's 'Agroforestree' database is a species reference and selection guide for agroforestry trees. The main objective of the database is to provide detailed information on a number of species to field workers and researchers who are engaged in activities involving trees suitable for agroforestry systems and technologies. It is designed to help them make rational decisions regarding the choice of candidate species for defined purposes. Information for each species covers species identity, ecology and distribution, propagation and management, functional uses, pests and diseases and a bibliography.

Currently, ICRAF is updating the database and invites agroforesters to help identifying more species to be included. You can also contribute high-quality photographs. For more information, please visit ICRAF's 'Agroforestree' database site at http://www.icraf.cgiar.org/treessd/AFT/AFT.htm.

New publications

Agroforestry Guides for Pacific Islands, edited by Craig Elevitch and Kim Wilkinson (Permanent Agriculture Resources, Holualoa, Hawaii, USA, 2000)



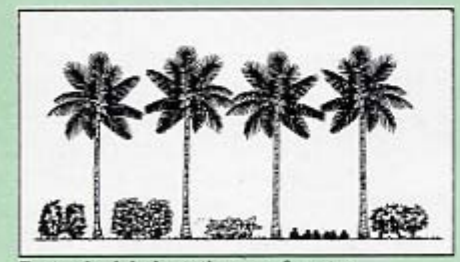
The Pacific Islands have a rich tradition of agroforestry, building diverse and highly productive agricultural systems with a variety of strategies and species. *Agroforestry Guides for Pacific Islands* synthesize cultural, historical, scientific and technical information into practical guidelines for planning, installing, and enhancing agroforestry systems.

Written by and for agroforestry practitioners, field-level extension workers and farmers, this new publication provides well-researched, concise, user-friendly planning information for a number of agroforestry practices. Topics covered include traditional multipurpose trees and their uses, understory intercropping, land rehabilitation, expanding traditional agroforests, nontimber forest products, windbreak design, timber and fruit production, and more. Species tables with useful information on hundreds of species used in Pacific Island agroforestry systems are included. Each chapter also contains extensive resources for additional guidance on the subject covered, including books, magazines, helpful organizations, and Internet sites. Each self-contained chapter/guide in this publication can be reproduced for training and educational purposes.

This new publication is an invaluable practical resource for those working to conserve and expand the use of trees in agricultural systems.

Example illustrations by Christi A. Sobel:

Indigenous Pacific Island agroforestry



Post-colonial plantation agroforestry

Modern/urban agroforest home garden

Agroforestry Guides for Pacific Islands, written and published with the support of the Western Region Sustainable Agriculture Research and Education (WSARE) Professional Development Program, consist of eight self-contained chapters/guides covering the following topics:

1. Information resources for Pacific Island agroforestry
2. Multipurpose trees for agroforestry in the Pacific Islands
3. Nontimber forest products for Pacific Islands: An introductory guide for producers
4. Integrating understory crops with tree crops
5. Introduction to integrating trees into Pacific Island farm systems
6. Choosing timber species for Pacific Island farm forestry
7. Economics of farm forestry: Financial evaluation for landowners
8. Multipurpose windbreaks: Design and species for Pacific Islands

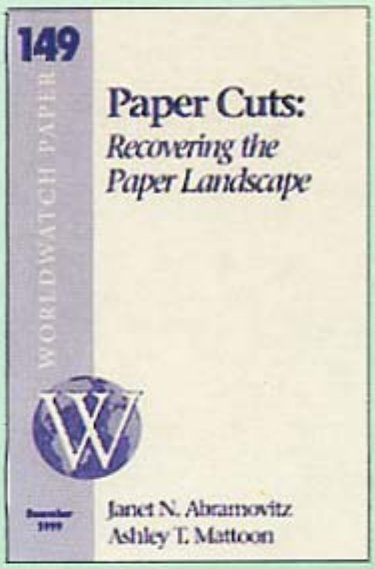
Further information on *Agroforestry Guides for Pacific Islands* is available from:

The Director, Permanent Agriculture Resources (PAR)
PO Box 428, Holualoa, Hawaii 96725, USA
Tel: 1.808.3244427, Fax: 1.808.3244129
E-mail: par@agroforestry.net

You can also contact PAR if you want to order this publication (Price: 24.95 US Dollars plus shipping). Additionally, online orders can be made at http://www.agroforestry.net or http://www.amazon.com. Not least, the *Agroforestry Guides for Pacific Islands* can be downloaded for free in PDF format at http://www.agroforestry.net.

New publications

Paper Cuts: Recovering the Paper Landscape, Worldwatch Paper 149, by Janet N. Abramovitz and Ashley T. Mattoon (Worldwatch Institute [http://www.worldwatch.org], Washington, D.C., USA, 1999)

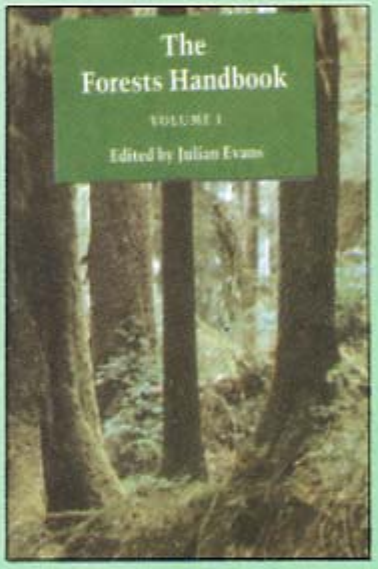


Global paper use has grown more than six-fold since 1950. One fifth of all wood harvested in the world ends up in paper. Pulp and paper is the 5th largest industrial consumer of energy in the world, using as much power to produce a ton of product as the iron and steel industry. In some countries paper accounts for nearly 40 percent of all municipal solid waste. "We have the tools at hand to dramatically lessen the impact of paper on the world's forests, as well as to reduce energy use, air and water pollution, and solid waste", said the authors. "And as businesses like Bank of America, United Parcel Service, and Proctor and Gamble have discovered, saving paper saves money too."

Paperback copies (Price: 5.00 US Dollars) or free PDF downloads are available at:

https://secure.worldwatch.org/cgi-bin/wwinst/WWP0149 (URL is case sensitive!)
http://www.worldwatch.org/promo/wwp149.pdf

The Forest Handbook (two volumes), edited by Julian Evans (Oxford, UK, 2000)

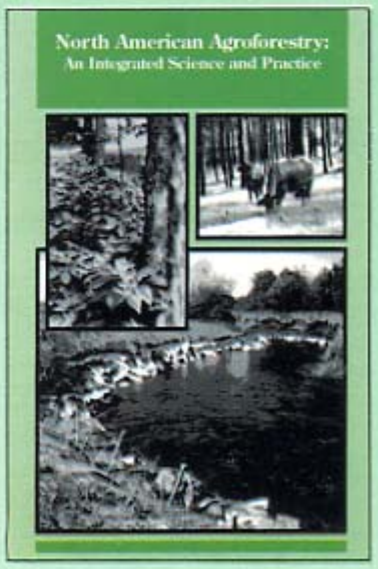


Rising concerns over the effects of deforestation and climate change are highlighting the need to conserve and manage existing forests through sustainable forestry practices. This handbook, written by an international team of scientists and practitioners, presents an integrated approach to forests and forestry, applying our present understanding of forest science to management practices, as a basis for achieving sustainability. Volume one presents an overview of the world's forests; their locations and what they are like, the science of how they operate as complex ecosystems and how they interact with their environment. Volume two applies this science to reality; it focuses on forestry interventions and their impact, the principles governing how to protect forests and on how we can better harness the enormous benefits forests offer. Case studies are drawn from several different countries and are used to illustrate the key points.

Hardback copies (Price: 185.00 GB Pounds Sterling plus shipping) can be ordered at:

http://www.blackwell-science.com/~cgilib/bookpage.bin?File=4613

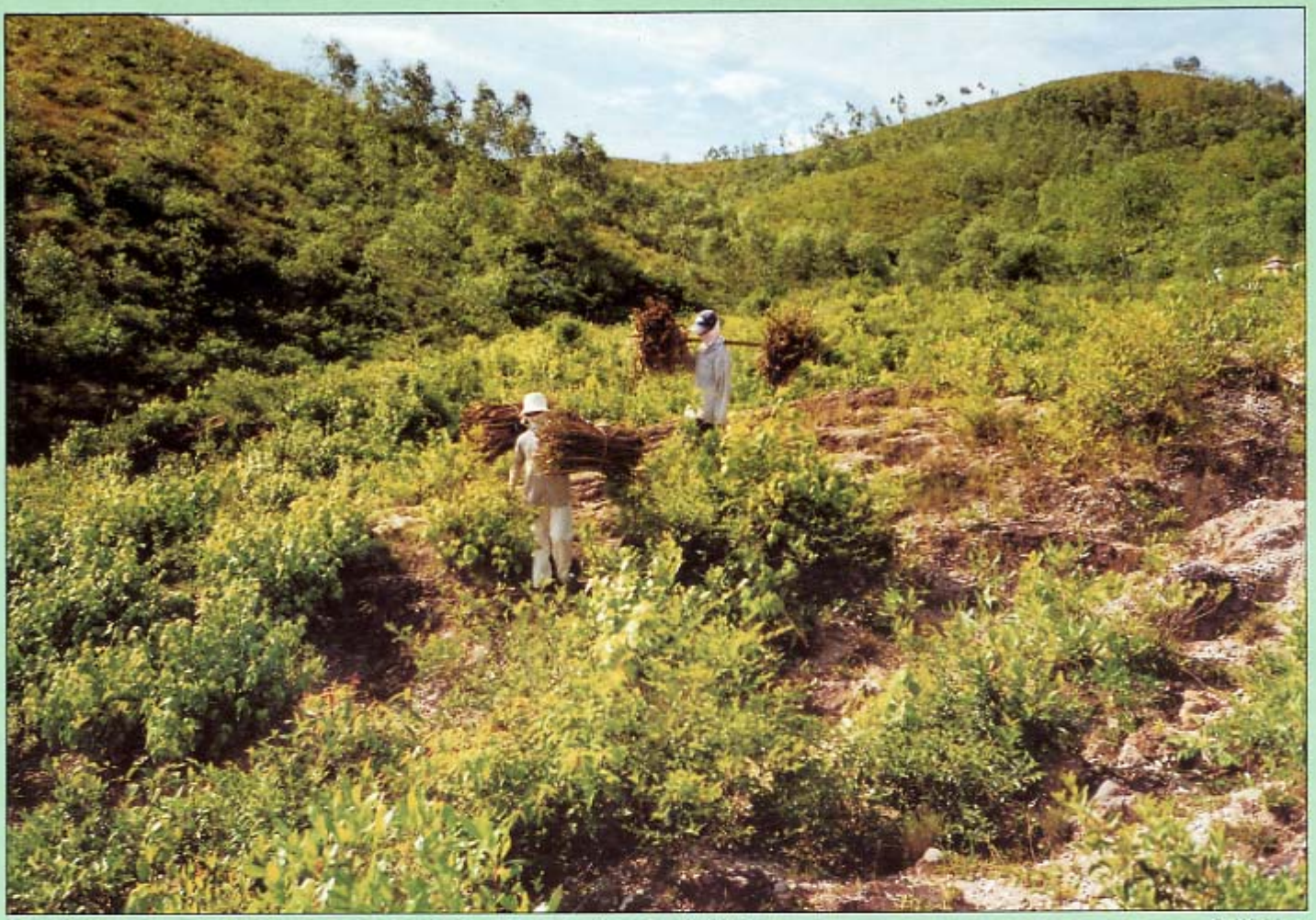
North American Agroforestry: An integrated Science and Practice, edited by H. E. Garrett, W. J. Rietveld, and R. F. Fisher (American Society of Agronomy [http://www.agronomy.org], Inc., Madison, USA, 2000)



The first few chapters of this college-level book focus on the development, ecological foundations, and the status of agroforestry. Separate chapters cover technical aspects of the five major agroforestry practices, namely windbreaks, silvopastures, alley cropping, riparian forest buffers, and forest farming. Each is unique, and is interdisciplinary in purpose and operation. These systems are evaluated in later chapters that integrate the socioeconomic factors and project the future of agroforestry.

Hardback copies (Price: 50.00 US Dollars plus shipping) can be ordered at:

http://www.asa-cssa-sssa.org/cgi-bin/Web_store/web_store.cgi?page=o_q_books.html&cart_id=3803832_16046



Fuel wood collectors in the barren uplands of Quang Nam province, Central Vietnam S. Weidner

Cinnamon (*Cinnamomum cassia*) is a popular tree with farmers in Quang Nam province, Central Vietnam S. Weidner