Agro-forestry at the United Nations University and its evolving role: introductory remarks.

CONTRACT TEXT
EXPAND CONTENTS
DETACH
NO HIGHLIGHTING

Social, Economic, and Institutional Aspects of Agro-forestry (UNU, 1984, 95 pages)

Foreword

Agro-forestry at the United Nations University and its evolving role: introductory remarks

Position papers

Other papers

Recent UNU publications of interest

Foreword

The Workshop on Agro-Forestry, jointly sponsored by the United Nations University and the Albert-Ludwigs-UniversitÃ¤t, Freiburg, was held at the Geographische Institut II of the University, Freiburg-im-Breisgau, Federal Republic of Germany, from 31 May to 5 June 1982.

It was the fourth of a series of workshops on agroforestry sponsored by the UN University, previous ones having been held at Turrialba (Costa Rica), Chiang Mai (Thailand) and Ibadan (Nigeria). The theme of the fourth workshop was The Social, Economic, Institutional, and Legal Aspects of Agro-forestry, and the Constraints these Imposed on Development.

The workshop was directed by Professor Walther Manshard, former Vice-Rector for the Programme of Management of Natural Resources of the UN University, and now Director of the

Geographische Institut; Professor Hansjuerg Steinlin, former Director of the Forest Resources Division, Food and Agriculture Organization (FAO), and now Professor fur Weltforstwirtschaft und Landespflege at Freiburg University; and Dr. Gerardo Budowski, UNU Programme

Co-ordinator for Agro-Forestry Systems, Tropical Agricultural Centre for Research and Training (CATIE), Turrialba (Costa Rica). The workshop was attended by thirty-one participants from fourteen countries.

A number of field workers with practical experience in agroforestry had been invited to submit papers based on their views and experience to four moderators (Mr. J.E.M. Arnold, Dr. Kamia Chowdry, Professor S.K. Adeyoju and Dr. Peter Huxley). Each moderator then prepared a position paper based on analysis of the papers submitted and his or her own experience. Presentation of each position paper was followed by discussions, which in each case lasted for the best part of a day, and a summary of which is included in these proceedings. Other papers were not read individually at the workshop but were circulated at the different meetings.

Participants in the workshop would like to thank the organizers, not only for the very efficient arrangements for the workshop itself, but also for the very enjoyable social and cultural activities which accompanied it.

Agro-forestry at the United Nations University and its evolving role: introductory remarks

Gerardo Budowsky

The agro-forestry project at the UN University began in 1977. Its aim was to build up a network for the promotion of research and training in selected aspects of agroforestry, by supporting centres of excellence, and facilitating the exchange of scholars between developing countries ("South-South"). It was requested that the project should relate to other UN University activities, notably the projects on highland-lowland interactive systems and rural energy systems, and to certain aspects of the "World Hunger" and "Human and Social Development" projects of the UN University.

CATIE, at Turrialba, Costa Rica, became an associated institution of the UN University on the basis of its ongoing programme of agro-forestry research and graduate training, supported by the

Direction de la Cooperation et du DÃ©veloppement et de l'Aide Humanitaire (DDA), Switzerland, and later also by the Deutsche Gesellschaft fÃ¼r Technische Zusammenarbeit (GTZ) of the Federal Republic of Germany and the Agency for International Development (AID) of the United States. The programme sponsored at the UN University Headquarters at Tokyo and the International Co-ordinator at CATIE, has engaged in the following activities since 1977:

1. Retrieving and Quantifying Existing Knowledge

A series of systematic workshops on the state of knowledge of agro-forestry was organized at CATIE, Costa Rica (1979, proceedings published in Spanish and English), Chiang Mai, Thailand (also in 1979; Chiang Mai University became the second UN University associated institution), and at the International Institute for Tropical Agriculture (IITA) in Ibadan, Nigeria, in 1981 (proceedings in press). All these meetings followed a somewhat similar pattern; co-sponsorship was obtained from the local institutions, as well as in various degrees from different international or regional organizations such as the International Centre for Research in Agro-Forestry (ICRAF), FAO, and the International Development Research Centre (IDRC), Canada, among many others.

Specialists from the countries of the region provided papers which were discussed. enabling conclusions to be drawn. The emphasis was mainly on the humid tropics, as this ecological region has been neglected hitherto.

2. Broadening the Conceptual Framework and Promoting Field Research

It was felt that agro-forestry in many parts of the world had become an act of faith, meaning different things to different people. So the programme contributed to the establishment of the boundaries defining what agroforestry is, and what it is not; where it can be applied, and where not. But of particular importance was the quantification of both existing traditional practices and newly designed systems. This led to a series of publications dealing with an area (La Suiza, close to Turrialba) where traditional agro-forestry systems linked to coffee and pasture were widely practiced.

3. Building up Centres of Excellence as Part of an Effective Network

Besides CATIE and Chiang Mai University, steps have been taken

to strengthen other existing centres in West Africa and South-East Asia, according to their special capabilities and potential for radiating knowledge over a wider area.

4. Promoting Interchange of UN University Scholars

At present the flow has been towards CATIE, to which a total of thirteen scholars (six from Thailand, two from Indonesia, two from Tanzania, one from Venezuela, one from Peru and one from Nigeria) have been sent. In the future it is planned that the flow will also move in other directions.

5. Establishing Links with Other Relevant Organizations

Most outstanding have been various co-operative ventures with ICRAF, FAO, the International Union of Forestry Research Organizations (IUFRO), United Nations Environment Programme (UNEP), AID, DDA (Switzerland), GTZ and Deutsche Stiftung fÃ¼r Internationale Entwicklung (DSE), Federal Republic of Germany, and IDRC (Canada). ICRAF, with its various technical meetings, has played a particularly valuable role, as has the FAO in its activities and publications on social forestry (the important role of forests for local communities).

Socio-economic Constraints in Agro-forostry

While some of the socio-economic aspects of agroforestry were mentioned at the three workshops organized by the UN University. the information retrieved and the research carried out tended to concentrate largely on the biological aspects. The same is true of the ICRAF meetings. Yet there is much to learn in the socioeconomic field from existing agro-forestry systems, such as, for example, the use of shade trees for cocoa, coffee, and in pastures in Latin America; the use of live fenceposts; Indonesian experience on home gardens; and African experience in taungya. Even the scanty research which has been undertaken on socio-economic aspects has placed most emphasis on strict cost-benefit relationships, and has neglected social and legal aspects, and the importance of improving social welfare. Obviously, the study of the socioeconomic factors in agro-forestry is still in its infancy. It may well be a more complicated aspect for study than other factors, but this is no excuse for not facing the necessity for such studies. More important than anything else, perhaps, is that the local people's perception of economic and social factors needs to be carefully studied and understood and, it is hoped, quantified and incorporated into action plans.

That is why the Freiburg Workshop was organized. The usefulness of the exercise will certainly be far more than academic. It is not that we can pretend to solve most problems. But agro-forestry, as seen - or rather "rediscovered" - by scientists, is here to stay. It has become an essential part of foreign-aid programmes, both multilateral and bilateral, and at present an increasing number of publications are being produced. Let us hope that the deliberations at the workshop will provide useful guidelines for the orientation of such cooperation, as well as promoting research, education, and training in the socioeconomic field. Most of all, it is important that the subject of socio-economic restraints should be approached on the basis of sympathy towards rural farmers, and the way they perceive and practice agro-forestry, so that wherever possible methods can be improved, and the age-tested knowledge of the farmers can be adapted for use in other parts of the world.

Economic constraints and incentives in agro-forestry

J.E.M. Arnold

Introduction

The term agro-forestry has been used recently to cover many dissimilar systems and activities. It is used in this paper to describe any situation in which trees form part of the agricultural production system. The focus throughout is on the developing world, with emphasis on the small farm.

Discussion of the economics of agro-forestry defined in these terms must centre on its costs and benefits to the farmer- what costs he faces which discourage or prevent him from incorporating tree systems, and what returns and other benefits could he obtain from them. Costs and benefits to a poor farmer, living partly or wholly within a subsistence system, take forms other than cash outlays and incomings. Prominent among his implicit calculations is usually consideration of risk; the need, when living at the very margin of existence, to avoid any change which might leave him even worse off than he is now. Discussion must therefore reflect these and other realities which shape the farmer's economic decisions, and must not be confined simply to monetary assessments of profitability.

Intruding on the farmer's decisions there are often the interests of government in encouraging agro-forestry in order to stabilize land use, to diminish environmental and resource damage, and to develop forest resources at low cost. These benefits spread much

more widely than just to the farmers concerned, but are usually achieved only by imposing additional costs upon them. The paper therefore also considers the implications of the differences in economic objectives and impacts as seen by the farmer and by the general community.

A further issue that needs to be addressed concerns the differential impact of programmes to introduce agro-forestry activities upon different segments and members of a community. Some are likely to benefit more than others; some possibly are excluded altogether from the benefits or are even disadvantaged by the changes. The equity and distributional aspects of agro-forestry projects are therefore also reviewed.

In the next section of the paper economic benefits are listed, with economic constraints and costs in the following section. The final section reviews various measures that can be taken to make agro-forestry systems viable and attractive, by reducing economic constraints and capturing economic potentials.

Many of the constraints discussed in the paper reflect basic changes and disruptions in rural societies and economies in the developing world. A full treatment of the economic parameters of present-day agro-forestry systems would need to take into account a wide panorama of changes and change agents affecting the viability and function of rural social institutions and farmers' attitudes. Frequently, basic institutions such as the community are breaking down without any mechanism for replacing the services they provided. Growing pressures on the land have widely reached the point at which the perception of farmers of their needs and their abilities to meet them - have drastically changed.

In order to reduce the subject to manageable proportions the present paper focuses rather narrowly on the immediate impacts of these broader changes on the viability and acceptability of agro-forestry systems. However, what is being described is often but a symptom of much more fundamental pressures, and needs to be kept in mind in discussing the subject.

Economic Benefits and Incentives

The widespread occurrence of trees in traditional agricultural systems throughout the tropics provides evidence of the benefits that farmers obtain from their presence. These benefits can be divided into a number of broad categories,

The most widespread benefit from agro-forestry systems is their function of maintaining or restoring the productivity of the land. This underlies all systems of noncontinuous cultivation which incorporate a period of tree fallow in the farming system; and as Jackson has pointed out, a widespread flaw in programmes designed to modify or replace shifting cultivation is the failure to recognize the fallow as an integral part of the agricultural system. The soilenriching impact of trees is also commonly one of the principal economic incentives to participation in taungya and taungya-type rotational systems within the forest; they provide the farmer with access to fertile land (King 1968).

Trees also perform this soil-enriching function in certain permanent cultivation systems; for example, being intercropped as alley crops to raise nutrients to the surface layers of the soil through litter or green mulch, a function often combined with addition of nitrogen through use of leguminous tree species. In other words, they provide a lowcost alternative to fertilizers and soil conditioners. Trees are also employed to protect the soil, by providing shade, shelter from wind, protection from destructive rain impact on the soil, reduction in soil loss through row plantings to check runoff, etc.

A second widespread beneficial impact of trees is in increasing the total output of the land by adding a tree crop to one or more lower layers of crops. The intercropped species selected have root and above-ground structures which make complementary use both of different layers of the soil and of the space exposed to sunlight above the soil surface. A wide variety of such vertically structured multiplecrop combinations are found in the tropics.

Associated with this benefit is the advantage obtained by diversifying the range of outputs from the farm, by including a number of products of tree species in order to reduce the risk to subsistence or income due to the failure of individual crops, and to provide usable or saleable produce over a wider seasonal time-span than would be possible with only one or a few crops. In one of the more commonly occurring agro-forestry systems, the home garden, tree crops provide products which complement the high-calorie foodstuffs grown elsewhere in the farm system (Wiersum 1981).

A third category of benefit is that of raising incomes by exploiting tree crops which provide higher returns from the land than alternative crops. Recent studies have shown, for example, that eucalyptus grown on irrigated land in Gularat, India, to produce

poles and firewood for sale (Gupta 1979), and Albizzia falcataria grown on agricultural land in Mindanao, Philippines, for sale as pulpwood (Hymen et al., n.d.) produced higher returns to the farmers than the agricultural cash crops they displaced.

By better use of available resources, trees can also be an additional source of income. Less labour-intensive systems of tree-growing can be used to allow farm families to utilize more of the available land; tree-growing is less tied to seasonal patterns than most crop production and, where land is not a constraint, more use of labour resources is possible than with agricultural crops. This, for example, was an important factor in bringing about the increase in the net incomes of the pulpwood tree-farmer programme in the Philippines described by Matela.

Tree products can equally contribute to reduction in costs. Materials needed to meet essential local needs, such as fuel, forage and building materials, may be provided at lower cost by growing trees rather than using alternative sources of supply.

Trees can also provide a capital reserve for use in emergency, or to meet exceptional cash outlays. Trees are widely grown for this purpose by farmers; as they do not have to be harvested at a particular time, and usually accrue in value over time, they have unique value in this respect.

Usually the tree component of an agricultural system contributes more than one of the above economic benefits. For example, the leguminous Acacia senegal planted in the fallow areas in Sudan, not only enriches the fallow, it also produces a marketable product - gum arabic - which is an important source of income to the farmers, as well as fuelwood, fodder, fibre for rope-making, and other outputs of local value.

Economic Costs and Constraints

The economic pressures militating against agro-forestry systems are of two overlapping kinds. There are the pressures which are causing the breakdown of existing systems, and the destruction and removal of the trees they contain (as is happening, for example, to the village tree resources of the plain areas of Bangladesh and the gum gardens of the Sudan), and there are pressures which discourage the introduction of trees in situations where there are no trees in the agricultural system at present.

The most widespread constraint to both retaining and adding

trees is probably that of growing competition for land under pressures of expanding populations on a limited land base. Though trees constitute a productive element in so many traditional agricultural systems in the tropics, and are essential for sustained production from the land, as land becomes scarcer the overriding need to produce food and income in the short term naturally takes precedence over these longer-term values. A central challenge in introducing agro-forestry systems is to be able to do so in a manner which meets these immediate needs as well as the longer-term aims of stability and sustained productivity.

This conclusion about the impact of growing pressure on the land base needs to be qualified. Some of the more widespread agro-forestry systems - the home or tree gardens of Asia and the compound farms of Africa where themselves responses to earlier, slower increases in pressure on the land. As the forests receded farmers took to planting tree species of economic value on the farm, usually around the house, working out over time the most efficient and sound mixture and structure of different species (e.g. Okigbo 1977). In this way trees have been maintained in large numbers even in such densely populated areas as the plains of Bangladesh and Java.

Such systems have often proved very resilient; in Java their area has even increased as population has grown in recent times, apparently because their productivity is higher than the areas devoted solely to crops. However, eventually even these systems break down. As overall farm size decreases with the fragmentation accompanying population growth, the proportion devoted to home gardens rises at the expense of the area of staple food crops. But when farm size falls below a certain point, farmers increasingly forego the tree products in favour of staple food-crop production (Wiersum 1981).

This underlines a basic constraint in most agro-forestry systems in terms of their contribution to alleviating the situation of the very poor: that it is often difficult to adopt them on very small farms, and that they contribute nothing directly to the landless unless schemes can be devised to give these people access to land.

Population growth also endangers existing agro-forestry systems through the resultant growing pressure on the tree resource, raising the value of the latter to the point at which economic pressures to cut and use it exceed its value as a continuing part of the agricultural system. Recent work in Bangladesh has shown that the villagetree resource though it is comprised mainly of fruit trees

planted in the village areas - is being cut at a rate far in excess of its replacement, principally to provide fuel. With the other locally available organic fuels from agricultural wastes already fully used, the tree resource provides the only reserve from which to accommodate the rising fuel needs of growing populations. At the same time this population growth requires more housing in the village area, so reducing the area available for the tree resource (Douglas n.d.).

A powerful component in the increase in economic pressures to cut and use existing tree resources is the growth in urban and industrial demands for wood - in particular for fuelwood and charcoal. Again, however, it is necessary to recognize that rising values for tree products also provide a major economic incentive to investment in husbanding and growing trees. Brokensha and Riley (1978), for example, have described the process in an area in Kenya of transformation of wood from an abundant, free item to a commodity of value, to be brought under control, protected and perpetuated.

Shifts in the values and costs of other uses of the land can also have impacts on trees and agro-forestry practices. Corvanich has described an example of market pressures which have encouraged farmers to introduce crops which directly or indirectly lead to the removal of trees. "Modernization" of tropical agriculture, and the economies of scale, support services and marketing opportunities it attracts, favour monocultures which replace the traditional multiple cropping systems of tropical agriculture in which trees often featured. Similarly, trees are also usually incompatible with mechanization, creating impediments to the use of machinery, and are therefore removed. New varieties of tea and coffee to be grown in the open also result in the removal of the shade tree intercrop.

The discussion so far has been mainly in terms of economic pressures which discourage the retention of trees in existing systems. There are also economic costs for farmers in introducing trees. One of the most important of these is the relatively long production period of most tree species. Poor farmers can seldom divert resources from producing to meet immediate needs for food and income to a tree crop which will start producing returns at best a few years into the future. Hence the widespread preference in agro-forestry for fruit trees and other tree species which yield outputs of value other than wood, and do so early in their production cycle.

The length of the production period imposes another economic constraint; it increases the level of risk for those, such as tenant farmers or farmers practicing shifting cultivation on state land, who do not have security of tenure of the land they cultivate. Few will invest in a long-term crop such as trees if they fear that they will not be present to harvest the returns in the future. Thangam and Corvanich have pointed out that this is a fundamental constraint to agro-forestry; to rectify may well need changes in basic legislation affecting control of the land.

Sheng has drawn attention to a number of other features of trees which could make them costly to the farmer - for example, competition with neighbouring crops for water, nutrients and light; and emission of substances toxic to other plants. It is important to recognize both what the costs of trees are to farmers, and also that these costs may weigh much more heavily in his economic calculations than in those of a forester or entrepreneur. Protection of trees against livestock or termites, for example, may impose a cost greater than the farmer can meet. Formulation of viable agro-forestry packages depends very heavily on being able to identify tree species which do not place such "costs" on farmers - a characteristic likely to outweigh such conventional forestry choice criteria as yield and form in the farmer's calculations (Poulsen 1981).

Although, as has been pointed out earlier, agro-forestry activities may sometimes enable economic use to be made of surplus labour, in other instances shortage of labour may prove to be a serious constraint. Some agroforestry operations are likely to compete with peakseason labour demands. In off-season periods labour often migrates to work opportunities elsewhere. Some of the operations, such as the logging of smallholder-grown pulpwood in the Philippines, may require labour inputs in excess of what can be provided by the farm family, so that they have to hire additional help.

There can also be more fundamental economic pressures preventing or discouraging farmers from introducing trees into their agricultural practices. Farmers in the developing world are widely faced with pressures to change their agricultural system, changes which usually cannot be accomplished solely with traditional knowledge, skills and resources. During the transitional period to the new system the farmer is likely to find it difficult to abandon such traditional practices as burning and overgrazing which are inimical to tree-growing (Openshaw and Moris 1979). Similarly, the tradition of investing wealth in livestock in grazing

systems in Africa has persisted because alternative investment outlets have not been developed in these systems - to the point where livestock numbers build up to levels which result in destruction of the tree vegetation (von Maydell 1979). As was pointed out in the Introduction, some of the constraints to agro-forestry thus stem from the much wider changes and disruptions that are occurring in the rural societies and economies of the developing world.

Matching Agro-forestry Activities to Economic Opportunities and Constraints

Some of the more important measures often needed in order to remove or reduce economic constraints to adoption of agro-forestry practices (and to realize the economic opportunities) involve institutional and legislation change. Initiatives in these areas are usually needed to resolve issues concerned with community level organization and management, government support to the participants and their training in new skills, and the critical issues of security of tenure and distribution of benefits. As institutions and legislation are the subjects of two other sessions of the workshop they are not discussed further in the present paper.

Analysing the Situation

The task of defining viable, acceptable, agro-forestry projects rests very heavily on success in identifying the relevant factors in the local situation. Some agro-forestry programmes, such as those described by Thangam, are very complex, being designed to provide alternatives to shifting cultivation which entail changes to the whole way of life of the people concerned. As he explains, a whole range of investigatory measures will be needed in such cases, in order to understand what might be successfully achieved.

Even where the agro-forestry project is no more than the insertion (or modification) of a single element in a system, it may have numerous interrelationships within the system which need to be properly understood in order to be able to identify how to intervene to improve the situation. For example, fuelwood supply and use in a rural village is likely to be influenced by other economic values of local trees, availability of alternative organic fuels (dung, crop residues), and other economic uses of these materials, access to land and uses of that land, village power systems, pressures on farm and household labour budgets, and differential sets of priorities and values within the village - to name

but some of the relevant factors (Ready, in press). Without a sound understanding of all these relationships, it is unlikely that it will be possible to define the interventions which will have the desired effect.

Identifying Costs and Benefits

Equally important is the correct identification of the costs and benefits to the different protagonists. Calculation of benefits and costs from points of view of the village and of the forest service will generally lead to different assessments of the same project (Romm 1980). The objective of a forest service in a taungya project, for example, is usually establishment of plantations at low cost. The objective of the participating farmers is to improve their food and income situation. Common features of taungya practices imposed by forest departments in pursuit of their objectives impose costs and constraints on the farmers which are increasingly unacceptable to them. A survey of taungya farmers in southern Nigeria in 19751976 for example, showed that the physical labour involved, the restrictions on cropping practices which curtailed the cash income potential, the insecurity, and the lack of social and physical infrastructure and services, all acted as negative factors, most of which could be partly or wholly rectified by changes in the way taungya is applied (Ball 1977). Failures in the past to adapt the system to farmer objectives as well as forest service objectives have led one recent writer on the subject in India to describe it as "frankly exploitative in concept and operation" (Seth 1981). It is the exploitative nature of past applications which are largely responsible for the widespread breakdown of traditional taungya programmes in recent years, due to their rejection by participants and potential participants.

Similar divergencies of interest and perspective arise frequently in projects designed to replace shifting cultivation by settled agricultural practices where the latter require substantial investments in soil conservation structures (such as terraces), the benefits from which are as much environmental protection for populations elsewhere as increased income to the farmers. Where such disparities in purpose and impact arise, mechanisms must be devised for transferring resources so as to produce a favourable benefit-cost relationship for the villager as well as for the government. Examples of such transfer mechanisms are the subsidization of input and capital costs reported by Heymann, and found on a much larger scale in such successful programmes as village forestry in the Republic of Korea (Gregersen 1982), or the incentives given, amenities and services provided, and marketing

facilities arranged in the taungya-type projects described by Thangam.

Support mechanisms need to avoid creating a dependency upon outside inputs on the part of the recipients which would undermine their ability to become self-sufficient in operating agro-forestry systems. This concern has led to extensive debate over whether or not to pay for local labour inputs into agro-forestry projects. It is often argued that only voluntary provision of labour is compatible with the degree of commitment to the project necessary for its success. On the other hand, the community may be so poor and heavily burdened already, that it would simply not be able to cope with the additional tasks associated with the project unless it was accompanied by additional income from wages for the work done. Similar arguments have arisen over whether or not planting stock should be provided free of cost. Clearly there is no single answer to such questions. They have to be decided on a case-by-case basis.

There are two other aspects of the differences in the value different people involved place on the socioeconomic impacts. One is the conflict (discussed by Hoskins) between indigenous and modern; the failure to recognize that for many rural people it is the variety of nonwood products from the indigenous forests which are of value - products which are not yielded by plantations or woodlots, the outputs from which often do not have value to the people dependent on indigenous forest. Projects which shift the use of forest land towards wood production may severely disrupt not only the subsistence base of forest people, but also the source of livelihood of often enormous numbers of other people, very often the landless and the poorest in communities, who gather and sell products from the forest (Arnold 1981).

The other point concerns the need to assess costs and benefits as they are actually perceived by the farmer. As has been noted earlier, in terms of the farmer's objectives, resources and constraints, the costs and benefits of trees are likely to be widely different from, say, the costs and benefits of the same tree to a forester.

Distributional and Equity Issues

The problem of divergent impacts of costs and benefits also arises very widely within the community. An agroforestry project is unlikely to have a similar impact on all groups or individuals within a village. Hoskins has shown how important needs and

perspectives within the community can be - and often are - overlooked or incorrectly interpreted in the identification process, leading to projects which neglect, or even adversely affect the landless, herders or women, for example.

However, the problem goes far beyond that of correctly identifying all those concerned, and of defining their needs and possibilities. Even if this is achieved, the much more difficult task remains of devising project interventions which can meet the needs of all. As Bishop points out, those with larger farms and greater resources are more likely to be able to benefit from an agro-forestry innovation than small farmers. Similarly, in grazing systems, those with larger herds are more likely to be able to benefit from an expansion of tree areas to provide arboreal forage than the poorer members of the community who possess fewer animals (Horowitz and Badi 1981).

The task becomes even more difficult and intractable if the objective is to use the agro-forestry activity as a tool to achieve a positive distributional effect in favour of the poorer parts of the community. Noronha (1982) has drawn attention to the many divergencies and conflicts of interest within communities under the heterogenous conditions found in India and many other parts of the world. Cost and benefit impacts of tree projects are likely to be different for different income groups, for different users of the land, for different components within the village power structure, and even - within the family - between men and women. For communal tree solutions to be feasible, there needs to be a tradition of communal action, the presence of communal land, and labour available at the right time. To succeed, agro-forestry projects need to be based on groups with shared economic objectives and situation, and a measure of socio-cultural homogeneity, which may often mean smaller groups than a village or the community (Noronha 1982). Recent work in Tanzania suggests similar conclusions (Skutsch et al. 1982).

The problems associated with the inequalities underlying these distributional aspects and equities have deep institutional and political roots, and to remove or ameliorate them could require far-reaching changes. Indeed, it has been recently argued that unless there is an egalitarian distribution of land, village-level forestry projects cannot reach those in most need of them - the poor and the landless (Agarwal 1980).

Economic Dimensions in Project Design

There remain a number of more narrowly operational measures which can contribute to economic viability and acceptability. Tree systems will seldom be interesting to farmers and other rural people unless they produce tangible short-term economic benefits. This can be achieved by using, or including, species which produce such benefits as fruits, fodder, etc., which mature early in their life cycle, as is described by Heymann and Thangam, or by using very fast-growing wood or fibre species, or by incorporating complementary income-generating activities such as mushrooms, kudzu fibre, etc., in village forest projects in Korea (Gregersen 1982), or honey, tasar silk, etc., produced in forest areas in Java (Soekiman and Banyard 1978).

Even with short gestation periods for tree products, the time horizons or capital costs may be such that farmers or communities need financial support until the trees are generating income. Credit for agro-forestry needs to be available on terms which are compatible with the timing and nature of the cash flows in and out of the project. For example, a recent evaluation of a smallholder tree-farming project in the Philippines by the agency providing credit to the farmers showed that the grace period and repayment terms had been consistent with the tree production period, but that the loan size and timing had not always matched the heavy expenditure the farmer incurred in harvesting the trees, and the credit procedures had discouraged the agricultural component by requiring the farmer to take out separate loans for trees and crops (Hymen et a/., n.d.).

Access to credit usually requires the farmer to be able to provide security for the loan. In the absence of legal ownership or tenurial rights, such security may be difficult to achieve, increasing the risk from tree crops. Certain economic measures can help reduce the risk element. Heymann has drawn attention to the importance of ensuring the marketability of the products before introducing new species of fruit trees to rural people. In the agro-forestry project, to produce pulpwood as a smallholder crop as described by Matela, firmer assurances of market and price, embodied in formal agreements with the purchaser, were needed to make tree-qrowing acceptable to the farmers. Heymann also underlines the importance of quality in relation to price and market acceptance, and yield, and the role of training and extension in transmitting necessary new skills and experience.

Agro-forestry systems can often be more complex than existing crops and farming practices. As Cornavich points out, ability to acquire the necessary skills will be influenced by the literacy of the

people involved. This factor underlines yet further criteria which, together with training and extension, impinge upon consideration of the institutional aspects of agro-forestry which are discussed in another part of the workshop programme. Generally speaking, new activities will be absorbed and adopted more easily if they are familiar, are related to traditional technology and materials, and if individual changes are kept small and simple. This seems to apply as much to agro-forestry as to diffusion of new technology in general (National Academy of Sciences 1982).

References

Agarwal, Bina. 1980. "The Woodfuel Problem and the Diffusion of Rural Innovations.,' Report submitted to the UK Tropical Products Institute.

Arnold, J.E.M. 1981. "Forestry for Community Development: A Problem Statement." Prepared for the XVII IUFRO World Congress, Kyoto, Japan, September 1981.

Ball, J.B. 1977. "Taungya in Southern Nigeria." Project working document, FAOIUNDP Forest Development Project NIR/71/546-14, Ibadan, Nigeria.

Brokensha, D. and B. Riley. 1978. "Forest, Foraging, Fences and Fuel in a Marginal Area of Kenya." Paper for USAID Africa Bureau Firewood Workshop, Washington, D.C. Social Process Research Institute, University of California, Santa Barbara, Calif.

Budowski, Gerardo. In press. "The Socio economic Effects of Forest Management on Lives of People Living in the Area: The Case of Central America and Some Caribbean Countries." in E.G. Hallsworth, ea., Socio-Economic Effects and Constraints in Tropical Forest Management, John Wiley & Sons, London.

Douglas, J. n.d. "Consumption and Supply of Wood and Bamboo in Bangladesh." Project Working Document No. 2, FAOIUNDP Project BGDI781010, Dacca, Bangladesh.

Gregersen, H.M. 1982. Village Forestry Development in the Repub/ic of Korea - A Case Study. Food and Agriculture Organization of the United Nations, Rome.

Gupta, T. 1979. "Some Financial and Natural Resource Management Aspects of Commercial Cultivation of Irrigated Eucalyptus in Gujarat, India. " Indian Journa/ of Forestry, 2 (2), 1 18-137.

Horowitz, M. and K. Badi. 1981. Sudan - Introduction of Forestry in Grazing Systems Forestry for Local Community Development Programme Series, Food and Agriculture Organization of the United Nations, Rome.

Hyman, Eric L., E.U. Seggay, R.S Joves and R.C. Carpio n.d "Tree Farming from the Viewpoint of the Smallholder: An Ex Post Evaluation of the PICOP Project." (Manuscript.)

King, K.F.S. 1968. "Agri-silviculture (The Taungya System)." Bulletin No. 1. Department of Forestry, University of Ibadan.

Maydell, H.J. van. 1979. The Development of Agro-forestry in the Sahelian Zone of Africa. In T. Chandler and D. Spurgeon, eds., Intemational Co-operation in Agro-forestry. Proceedings of an international conference. Nairobi DSE/ICRAF, pp. 15 29.

National Academy of Sciences. 1982 Renewable Energy Technology Diffusion in Developing Countries National Academy of Sciences, Washington. D C

Noronha, Raymond. 1982. "Seeing People for the Trees: Social Issues in Forestry." Prepared for the USAID Conference on Forestry and Development in Asia, Bangalore. April 1982

Okigbo, B.N. 1977. "Neglected Plants of Horticultural and Nutritional Importance in Traditional Farming Systems of Tropical Africa " Acta Horticulturae. 53.

Openshaw, K. and Moris J 1979. "The Socio-economics of Agroforestry." In T. Chandler and D. Spurgeon, eds.,

International Co-operation in Agro-forestry. Proceedings of an international conference, Nairobi. DSE/ICRAF, pp. 327-351.

Poulsen, Gunnar. 1981. Malawi- The Function of Trees in Small Farmer Production Systems. Forestry for Local Community Development Programme Series. Food and Agriculture Organization of the United Nations, Rome.

Reddy, A.K.N. In press. "Rural Fuelwood: Significant Relationships." In Wood Fuel Surveys. Food and Agriculture Organization of the United Nations. Rome.

Romm, Jeff. 1980. Assessing the Benefits and Costs of Social Forestry Projects. Indian Forester, 106 (7): 445 455.

Seth, S.K. 1981. Agro-forestry in India and Sri Lanka. Forestry for Local Community Development Programme Series. Food and Agriculture Organization of the United Nations, Rome.

Skutsch, M., J. Allen, D. Barnes and W. Ramsay. 1982. "Case Study of Social Forestry in Tanzania: 'Why People Don't Plant Trees'." Paper presented at the Annual Meeting of the American Association for the Advancement of Science, Washington, DC

Soekiman, Atmosoedarjo and Banyard, S.G. 1978. "The Prosperity Approach to Forest Community Development in Java." Commonwealth Forestry Review, 57 (2): 89-96.

Wiersum, K. 1981. "Tree Gardening and Taungya on Java Examples of Agroforestry Techniques in the Humid Tropics." Viewpoints on Agro-forestry. Agricultural University, Wageningen, The Netherlands.

Discussion

There was a need to assess costs and benefits, in particular how these were perceived by the small farmer who might have quite a different scale of values from the conventional economist, or from the specialist in agriculture or forestry. A number of examples were given. Quite often trees were not valued primarily for the wood they produced, but rather for some other property; for example, in Peru, for demarcating field boundaries; in Nigeria, for providing leaves for wrapping foodstuffs. A farmer might retain valuable trees for use by his sons, to build houses when they married, rather than cutting them for sale at the theoretically optimum time. The farming methods and other practices of small farmers in the tropics were mainly directed towards minimizing risk, rather than maximizing profits.

Farmers would be willing to engage in agro-forestry if they were sure that the benefits they received outweighed the costs (which might include such things as the sacrifice of leisure) they incurred. But the benefits must be such things as the farmer himself valued. It was often difficult for extension workers to know what farmers' priorities. as perceived by the farmers, were. Much more information was needed on this, and on the processes of decision-making by small farmers. To obtain this information extension workers needed a new approach, with fewer preconceived ideas. They must be prepared just as much to learn from farmers as to try to teach them. The agroforestry extension worker not only needed to be trained in new techniques but in new attitudes towards

farmers.

The costs and benefits from agro-forestry might not accrue to the same sectors of society. For instance, if one of the benefits was reduction of soil erosion - and hence of silting in streams - the beneficiaries would be people living in the valleys, rather than the farmers on the hillsides. Thus the valley dwellers, or the state representing society as a whole, should be prepared to pay part of the cost, or to give other incentives to the hill farmers.

Such incentives could be in the form of cash, reduction in taxation (which would only benefit wealthy farmers) or granting security of land tenure. Other incentives could be in the field of general social development, such as the provision of roads, water supplies and schools. There was, however, the problem of directly linking these social activities, in the mind of the individual farmer, with the agroforestry activities he was being encouraged to undertake.

Many agro-forestry activities would, of course, be of direct benefit to the farmer practicing them. It was necessary, however, to ensure that these benefits went to those who really needed them, and not only to large landowners. indeed it might happen that large farmers became better off, while smaller farmers and the landless suffered. Precautions should be taken against this.

In introducing new ideas considerable thought should be given to the effect they would have on existing social structures. However, some change in social structure might be essential if certain schemes were to be implemented successfully.

There was some discussion on whether agro-forestry should be developed from the top down - from government to farmer - or from the bottom up - from farmer to government. In practice both approaches were needed. Governments must prepare plans for land use on a national scale (or even in co-operation with other governments, on a supra-national scale), and must make provision for finance and staff. Farmers, on the other hand, must be involved in planning agro-forestry schemes at the local level. They should be able to say what they want and expect from the schemes, and should be encouraged to put forward their ideas on running them. Without this the success of the schemes was much less probable.

Continue

Agro-forestry, the rural poor, and institutional structures

Kamla Chowdhry

Introduction

The Freiburg Workshop on Problems of Agro-Forestry was intended to focus attention on the social. economic, institutional and legal aspects of agro-forestry programmed. Foresters and other professionals involved in studying and implementing various kinds of agroforestry projects were invited to write papers sharing their experiences, in order to highlight the social, institutional and legal factors that need to be understood for successful implementation of agro-forestry programmes.

Review and Comments on Papers

Nine papers from different countries were sent to me for review. In reading the papers I was struck by the "two culture" phenomena. The foresters and other related professionals mainly discussed the technical aspects of agro-forestry problems - aspects relating to land, soil conditions, water harvesting, production methods, ecological degradation, watershed planning and integrated area plans. The aspects of better understanding of people, and of the strategies to be used to obtain participation and collaboration of the so-called beneficiaries tended to be overlooked. The importance of people-oriented approaches was realized by almost all, but the problem was dealt with by normative statements such as "farmer participation is one of the most crucial problems of developing agroforestry", "unless people are convinced of the advantages, the proposed method would not be possible", or "cultural environment must be taken into account." These "ought" statements did not help the reader to find ways and means to find out how, under what conditions, with what kind of people, and under what social and cultural factors participation would be feasible.

Indications from several papers were that "top-down" approaches were being used, that governments and donor agencies were assisting in transforming societies, and that implementing officials were the principal agents of change. In the paper by the sociologist, the "bottom-up" approach to the problem and modes of attacking it was emphasized. She clearly brought out the importance of first understanding the needs and the experience-based knowledge of local people before new projects are formulated for their benefit. Examples were given where good projects backfired because unrealistic assumptions were made of the needs of local people.

In most papers it was assumed that experts and technocrats have a body of specialized knowledge which defines their comprehension of situations, problems and solutions. What was not brought out was that experts and their knowledge often have built-in biases and assumptions, which need to be re-examined in relation to the new situation and people concerned. Who defines the problem (the professional expert or the so-called beneficiaries), is significant because the definition of the problem in itself confers control over the situation. The professional reformer defines the problem in ways that maximize his own power and control over the situation. Similarly the beneficiaries are likely to define the problem in ways meaningful to them and which give them the control of resources.

Out of nine papers reviewed only one paper was by a woman. It was interesting that only in this paper was the problem of agro-forestry discussed from the perspective of women. In agro-forestry projects, especially those having components dealing with fuel, fodder, animal management, etc., women are the main workers. And yet it was rare to find that projects were formulated taking into account the needs and activities of women. With "male" and so-called "developmental" perspectives, projects often end up by making drudgery and the quality of life worse for women.

A recent example is from a remote Himalayan village, Dungra-Paitaoli, where women defied their menfolk in deciding on the choice of land use and protection of trees. The men wanted to sell a nearby forest to the Uttar Pradesh government so that it could be converted into a potato farm. But the women defeated this move. They already spent several hours collecting firewood and would have to spend more time walking, at least another five kilometres every day, to fetch fuel and fodder. The men wanted a potato farm for its cash income which they could convert into drink, but also for other "benefits of progress" a motorable road, a bus connection, perhaps a school which they hoped the potato farm would bring.

Influential villagers including the village head did not like the women's protest. They turned the question of land use into a men versus women issue and warned the villagers against accepting the leadership of women. They spread rumours that the village had been blacklisted because of the women's movement, that their youth would not be recruited to the army nor would the village be supplied with essential items like salt and kerosene. These rumours frightened the women but they were not prepared to withdraw their decision.

The Dungari-Paitaoli women have raised pertinent issues. as did the women in Upper Volta described in Dr. Hoskins' paper (Hoskins 1982). In effect they are saying that since the impact of deforestation falls largely on them, they should have the primary right to manage their forests. They are also challenging the right of men to be the sole decisionmakers when it is the women who spend long tiring hours everyday collecting firewood.

In discussing participation and the impact of projects on village communities, it is important to consider men and women separately. For instance in the Himalayan district of Chamoli, the Chipko leader, Chandi Prasad Bhatt has been organizing ecodevelopment camps to involve the villagers in tree plantation programmed. When the village assembly was first asked to make its choice of trees to be planted, the men immediately answered: "Fruit trees". Fortunately, the women, who had tasted success in the Chipko movement. argued vociferously that these trees would not benefit them at all. They said, "the men will take the fruits and sell them by the roadside. The cash will go to buy liquor and tobacco. No, we want fuel and fodder trees." Finally, both types of trees were planted, the fruit trees because otherwise the men would have lost interest in the ecodevelopment camps. Similar differences were found between men and women in other camps. It was also interesting to note that when the forest department was approached for seedlings of fuel and fodder tree species, it had either fruit trees (men's trees) or trees which yielded good commercial timber. It had few women's trees.

There is enough evidence pouring in from the developing world, whether in Asia. Africa, or Latin America, that unless women are involved in the mainstream of social and economic activities development will not take place. Policymakers, government officials, and analysts are usually male and seldom take into account women's specific interests and needs in the processes of economic growth and improving quality of life.

Participation of women and other disadvantaged groups in policy-making and administration becomes meaningful to the extent that participation challenges social assumptions and forces officials to confront the falsity of their assumptions, exposes gaps in their perceptions and, it is hoped, helps them to take corrective action.

In most papers the implementing agency for new agroforestry projects was the government, mostly in the form of a forest department or a forest development agency. How do forest dwellers perceive the forest officials and the forest bureaucracy? Do

the village people see the forest policy as helpful and the forest officials as agents of change in development? In general, the relationship has not been a happy one. The colonial heritage is continued by the black and the brown sahibs of the bureaucracy. In the Chipko movement, in the Himalayas, the local people have fought against forest policies and against forest officials and contractors to save their forests and villages. In 1972 the Forest Department gave a contract for ash timber to Simon Company, a manufacturer of sports goods, and denied the same wood to the local people who used it for making agricultural implements. The local people refused to let the contractors cut the trees by Chipko, i.e. clinging on to the trees. The movement spread from village to village. The women were the most active, for they knew what forests meant to them. Finally the government apppointed a committee to assess its policy of cutting trees in the valley, and its potential dangers of causing landslides, floods and erosion of river banks and hill slopes. The committee's findings were the same as the wisdom of the people, and it recommended a moratorium on tree cutting. It was only a strong people's movement that could challenge government policy; otherwise the poor villagers are too weak and passive to confront the might of the government. Having achieved some success the Chipko movement has now turned towards agroforestry and conservation practices to save their villages.

It is important where "top-down" approaches have been used that there are institutional mechanisms for "bottomup" questioning, otherwise policies and programmes are formulated which are detrimental to the poor. Also, programmes specifically meant for the poor often end up by benefiting the already well off, either because the poor do not know how to take advantage of the various policies and programmes, or because the rich know how to manipulate the system to their advantage, or a combination of both. An analysis of the many "poverty programmes" introduced by the government has shown that the benefits have not reached the poor.

Some papers have pointed out the need to reorient the bureaucracy. This is important if people-oriented approaches are to be used. On the other hand, it is worth asking the question whether the problem lies in the existing attitudes and behaviour of bureaucrats, or in the bureaucratic structure and its familiar pathologies - such as inappropriate procedures for developmental activities, literal emphasis on rules, generalist training, frequent transfers and postings, authoritarian and regulatory methods, intrabureaucratic conflicts and lack of coordination, etc. Reform

measures when undertaken are sporadic, slow, and so far without any major impact on the system.

The financial aspects of agro-forestry projects were mentioned in several papers. Detailed cost-benefit analysis figures, however. were not worked out. In Gujarat, progressive farmers have found that with an investment of 20,000 rupees per hectare for eucalyptus plantations they can obtain a return, after expenses, of 50,000 rupees per hectare over a five-year period, thus earning 6,000 rupees per year profit (Gupta 1979). Calculations indicate that the farmer is earning an internal rate of return of 13 per cent per annum. If the small and marginal farmer were to go in for such investment where would he turn for credit? What role can the banks play in providing easy access of credit to the small farmer? What other institutional mechanisms can be designed not only for access to credit but also to provide seeds, technical information and other inputs? The whole question of financial and other infrastructural support. including marketing and legal services for the small and poor farmer, needs to be considered in an integrated fashion if agro-forestry and afforestation of wastelands and degraded lands is to be tackled seriously.

In India the average price of fuelwood in industrial centres has increased 611 per cent over the last two decades. However, the benefits from this price rise have largely gone to the intermediaries and not to the poor farmers.

It is evident from the various papers that the scientific and technical knowledge required for agro-forestry programmes exists. There are international as well as national research establishments which work on tree species, soil conditions, grasses, water harvesting, production methods, etc. Progressive farmers have utilized this knowledge and arrived at a mix of practices which yields optimum results and considerable financial benefits. However, the problems of working with the small farmer. of working on village and community lands, and of evolving institutional structures that deliver technical and managerial services that do in fact reach the poor, are the key problems that need to be addressed. These are. in other words. problems of social organization and management and of developing institutional structures relevant and responsive to the rural poor.

The Rural Poor

In order to design institutional structures to provide services - technical, social and managerial - to reach the poor, and to give

them the power needed for effective social and agro-forestry programmes, it is essential to understand the nature of the poor and their relationship to bureaucracy and other resource-allocating structures. I shall present two cases which I hope will convey more realistically the problems of the poor in dealing with existing social and bureaucratic structures.

Case 1: Tribal Families of Balaheda

Balaheda has 260 families in the village (Bordia, 1979). Two-thirds of the land is irrigated. About 10 per cent of the families own 50 per cent of the irrigated land, and 40 per cent have small irrigated land holdings of up to two hectares. The remaining 50 per cent are the rural poor consisting of small agriculturists with unirrigated land, and tribal people whose source of income used to be collection of lac but whose income from this has disappeared with the depletion of forests. The tribal families have no land, there is 100 per cent illiteracy; and their skill in lac collection is no longer useful to feed their families. As would be expected, they are deeply in debt to the local money-lender.

At the suggestion of a local voluntary agency sixteen tribal families decided to seek a loan for the purchase of a buffalo each. They found that the local village credit cooperative society would not give them credit since they had no assets. With the assistance of the voluntary agency, a young bank agent who was a friend of the head of the voluntary agency agreed to provide the credit required for the purchase of the buffaloes. The sixteen tribal families then found that the common village grazing ground of 200 hectares was unavailable to them. It seemed that the custom was that grazing facilities were available only to those who had three head of cattle or more. Discussion and pleas with the local panchayat (village council) were fruitless. Approaching the local bureaucracy was found to be equally sterile. Unable to deal with the local power structure and the local bureaucracy the sixteen tribal families decided to sell their buffaloes. But even this step they could not take, for in order to repay the loan they would have had to sell whatever meagre possessions they had. At this stage the voluntary agency took up the matter, consulted the revenue law governing grazing lands, and obtained an injunction from the civil revenue courts which stated that the common grazing land could also be used by those possessing only one head of cattle.

The next battle was with the bureaucracy of the railways. Milk had to be transported every day by four tribal families to block headquarters where it was sold to a government dairy collection

centre. The local railway authorities, who were supposed to provide the prescribed railway concession for transportation, would not do so because the tribal families did not know how to fill in the right forms and what procedures to follow to get their application considered. The tribal families decided to go in a delegation to meet the divisional railway superintendent at Kota, an expensive and time-consuming journey they could ill afford. The meeting lasted exactly four minutes with zero results. The voluntary agency, again through personal contacts, and through newspaper publicity, finally secured them the desired railway concession.

The case illustrates the gap between the tribal families and the development agencies, the importance of "social structures," "power" and "class interests." The tribal people's access to institutional resources whether for credit, inputs, media or legal services was well nigh impossible without a sympathetic intermediary.

Development activities involving the poor - whether in dairying, agriculture, agro-forestry, health or education threaten to upset the delicate social and political balance existing in a traditional community. New opportunities for the poor are difficult to open and even more difficult to develop successfully without some strong outside help and intervention.

Case 2: A Marginal Farmer

Professor Ravi Matthai of the Indian Institute of Management, Ahmedabad, tells about the case of a marginal farmer who had wanted a small loan from the Small Farmers' Development Agency. In order to apply for the loan the farmer needed a record of his land holding size. The marginal farmer went to the talati, a junior government functionary in charge of land records in the village. The talati wanted a bribe of 50 rupees for providing this piece of paper. The marginal farmer was advised that there was strength in numbers. He collected a group of twenty other marginal farmers to march to the talati's office to protest against his behaviour. Just before they reached the office their courage failed. When people are living a marginal existence it is difficult for them to take a step which would earn them the displeasure of the talati, a petty officer who wields enormous power in the village since he is the keeper and the manipulator of land records. The rural poor with impoverished backgrounds are ill-prepared to deal with the talati of this world unless they are supported by strong intermediary agencies who can fight on their behalf.

Exploitation has become a way of life for both the exploiter and the exploited, passed on from one generation to another. To stand up against exploitation, to refuse to give a bribe, to unite in the form of a co-operative or a movement all such actions require self-confidence, an asset which the poor and the deprived do not possess.

In a recent International Workshop on Law and Resource Distribution in Singapore (Paul and Dias, in presse) the participants agreed that the most readily identifiable reasons for access difficulties centred in the bureaucracy. Case after case, country after country. cited the rebuffs and anxieties suffered by the poor at the hands of arrogant officials imbued with a superiority complex towards them. The uneasy client is curtly told to wait, often for hours, or is scolded for something or other. Some of the papers mentioned the need and necessity of reorienting the forest bureaucracy. This is certainly important, but it will not be easy. For too long the relationship has been of suspicion, mistrust and hostility. Participation, communication and collaboration under such circumstances is likely to be an uphill task.

It is clear from the two cases discussed above that structures of resource allocation are heavily weighted against the poor. This may be because of social and psychological reasons or class and caste differences, but the net result is the exclusion of the poor from the main stream of development. Alternative institutional structures are necessary which can not only help the poor and fight on their behalf but can also provide technical, managerial and other skills necessary for projects to succeed.

Institutional Structures

The most important programmes in social and agroforestry development have been initiated by government. The problem, however, is so enormous that there is need and scope in addition for voluntary and non-government agencies to work on these important issues of fuel and fodder on the one hand, and of conservation and ecological improvement on the other. I discuss below four kinds of institutional structure which have undertaken or have initiated social and agro-forestry programmes.

Bureaucracy: Government Programmes

The forestry departments of various states, encouraged with increased allocations from government and funds from the World Bank and other donor agencies have expanded their departments

and embarked on ambitious programmes. We will examine here the social and agroforestry programme of Gularat State which is considered one of the most successful of these.

The forests of Gujarat cover 1.96 million hectares about 10 per cent of the area of the state. The financial allocations for social forestry have increased from 0.4 million rupees in 1970/71 to 119 million rupees in 1981/82, an increase of 297 times over a twelve-year period. The department has undertaken strip plantations on roadsides, canal banks and railway sides; woodlots on village community grazing lands; reforestation of degraded forests; agro-forestry on private agriculture lands of poor tribal people; and farm forestry. The various programmes are suitably planned, implemented and monitored by the Forestry Department. Evaluation indicates that agroforestry programmes with progressive farmers on private lands have succeeded, as have plantations on roadsides and canal banks, and reforestation of degraded forest lands. But programmes focused on the rural poor have not been able to generate their participation or enthusiasm, a situation which seems to surprise the government officials because of the built-in advantages for the beneficiaries.

Regarding the woodlots programme on village grazing lands the report states: "Though the village woodlot scheme stands to benefit the village community individually as well as collectively, it has uniformly remained more or less a government programme." Regarding the programme for tribal people (malki lands) the report states: "The involvement of the tribal occupant of the land who stands to gain considerably from this programme has not been found to be adequate. A majority of the beneficiary occupants have shown little direct involvement in the plantations."

Government programmes, whether in Gujarat or any other state, have not been able to get local participation a precondition considered essential for the success of social and agro-forestry programmes. Also, as discussed earlier, delivery systems for the poor, whether in terms of credit, inputs, health or education, do not seem to reach the intended beneficiaries. The poor are either too weak or do not know how to defend their interests. In general, bureaucratic structures as at present constituted are grossly inadequate for tasks calling for solutions at the local level. Institutional alternatives which are more flexible and responsive at local levels need to be considered.

Co-operatives: National Dairy Development Board (NDDB)

Development planners and administrators including foresters have realized that (1) development plans from above have to be complemented by development from below; successful programmes in agriculture including agro-forestry require the inclusion and integration of marginal and disadvantaged groups; and (2) there should be a shift in strategy from an emphasis on achievement of targets to questions of equity, because of the entrenched power of vested interests.

In India one of the most successful programmes, which has helped bring out the potential creativity of the weaker sections and integrate them into the modernization process, is NDDB's Operation Flood. Operation Flood is based on a three-tiered structure of co-operatives which has organized the rural milk producers into powerful cooperative federations owned by the small producers. It has already organized 1 million farmers in over 5,000 village co-operatives. In its next phase it plans to organize another 10.2 million families. The Government of India has also requested NDDB to use its strategy and structure to organize farmers producing oilseeds, jute and vegetables, and those engaged in horticulture, fisheries and, most recently, energy plantations. Because the model developed has been extraordinarily successful it is worth considering it in terms of agro-forestry projects. The elements of the model that need to be highlighted are as follows:

Spearhead Team
The NDDB sends out a 'spearhead team' consisting of four to six professionals to the village where a cooperative is to be established. The spearhead team lives in the village and discusses with the villagers the importance of the co-operative, of organizing themselves, of the professional inputs required for increased productivity and incomes, and of marketing to benefit the producers. The spearhead team performs a consciousness-raising function and opens the door for further action. The team is conscious of the need to establish a relationship of trust, over a period of time, before they initiate a process of self-organization and change.

A farmer cannot be properly understood except within the context of his own special "universe." The universe includes all those things which influence his attitudes and shape his behaviour, the experience he is exposed to and that which he is deprived of. The spearhead team is taught the concepts of deprivation and powerlessness in order to realize how a person becomes what he is.

Local Team
The spearhead team begins to identify a local "shadow team" which can visit the headquarters at Anand (Guiarat), talk directly to the farmers already organized, discuss with them their fears and doubts, see for themselves the functioning of the co-operatives, and learn about the veterinary services and their organization and other related matters. In general, the "shadow team" goes through an excellent self-learning process. On their return to the village it is the "shadow team" that organizes the village co-operative and the various activities associated with it.

Village Co-operative
The members of the new milk producers' co-operative elect a managing committee at the general meeting. The managing committee elects its own chairman, and appoints a secretary, a milk tester and a milk collector from the village community. The local members learn the beginnings of organization and management. Such an institution, they understand, replaces the more exploitative structures that have kept them in a state of dependency. With such an institution functioning in their midst they can see that their own actions have made a difference, that it is possible to improve their lot and that it is worth the effort and the risk.

Supporting System
The organization and efficient functioning of village-level co-operatives is not likely to survive opposition by the traditional vested interests unless it is supported by a strong infrastructure with committed young professionals, and also strong governmental support. NDDB has a mobile veterinary route, a planning division which surveys potential milkshed areas, an engineering division which builds processing and fodder plants, a research and development division for new products, a national milk grid which uses computers to keep information on the demand and supply of milk from various state level federations, and a centre for training and developing the rural managers needed. The three-tiered cooperative structure is a powerful means of dealing with complex village-level problems including social, technical and political problems. In the case of Balaheda this massive support system was missing. Without such a support system the developmental activities do not sustain themselves. In addition there are problems of getting large financial resources, and of capital accumulation, infrastructural networks, and non-exploitative linkages which need to be established and nurtured.

The model for organizing small farmers and the support system

developed has been described in the case of milk co-operatives. I do feel the model has promise, with modifications, in organizing the tribal people and other small and marginal farmers for agro-forestry projects In fact the Gujarat government has recently appointed a working group to visit agro-forestry projects in the state as well as the NDDB co-operatives and their fodder farms, and recommend a viable model, with people's participation and control, for a massive programme of social and agroforestry.

Preliminary visits of the team have confirmed the proposition that wood co-operatives could be organized, and that members (especially the small farmers and landless people working on strip plantations on canal banks) would benefit enormously. In the present system the advantages of improved technology and increased prices bypass them because they have no market knowledge, and intermediary agents and contractors exploit them. The co-operative structure would establish its own nurseries, provide inputs and technical, managerial and marketing services, and also a mix of practices that would optimize land-use patterns. Within NDDB the establishment of a social forestry wing, to which experience could be transferred, is being considered; it will later be hived off to form an independent agency.

Professional Society: Society for Promotion of Wastelands Development (SPWD)

India has an area of over 300 million hectares of which nearly half, or about 150 million hectares, is not used for agriculture. Twenty per cent of this non-agricultural land is either in the high Himalayas above the tree line or in arid deserts where plant life can hardly be sustained. Of the remaining 120 million hectares, about one-third is in reserved forests under the direct management of state forestry departments; the remaining two-thirds are under private ownership, or are village and revenue lands. These lands are undergoing rapid degradation. They constitute the "waste lands" of India, although they are highly suitable for fuel and fodder trees and various kinds of scrubs and grasses.

Around 100 million people - the poorest in rural India, including tribal people and other disadvantaged groups depend on these forests and waste lands for their livelihood. If these waste lands could be brought into productive potential through programmes of social and agro-forestry, then the problem of energy and ecology, as well as the problem of unemployment and income generation for the poor, could be resolved.

An informal working group of key Indian leaders of government- Planning Commission. Department of Forestry, Department of Environment- private and public sector corporations. national banks. and community-based organizations. came together to establish a nongovernmental, non-profit organization called the Society for Promotion of Wastelands Development (SPWD). The principal objective of the society is to work with existing governmental, corporate and voluntary organizations to help promote the development of agro-forestry on lands owned by village and governmental organizations. The society provides technical services. training and information, and. in some cases. financial assistance to local communities wishing to implement agro-forestry projects. The principal financial support comes from funds of government and corporate members of the society in their own projects. In addition the society helps arrange bank loans to village level and other organizations for project support. The two largest banks of India are members of the society and have pledged credit support for these projects. The working philosophy of SPWD is based on the following premises

- The participation of poor people is essential to project success. It is realized that the enthusiasm and co-operation of the poor can only be generated by projects which yield an immediate sustainable and substantial economic return. The poor cannot be expected to sacrifice present income for long-term and uncertain rewards.
- The organization must ensure the equitable distribution of benefits. For such projects effective organizations are often community based, but they need the constructive support of government departments and regional institutions in research, training, planning and implementation.
- The community-based organization must be well managed. Many rural development projects fail because of weak management and because they do not take the time and trouble to overcome the initial scepticism of the participants.
- Appropriate and useful technical information must reach these organizations in forms they can understand. The problem is compounded by lack of audio-visual materials and arrangements for nonformal education of men and women implementing the projects.
- Because the people dependent upon the productivity of the waste lands are poor, external financial inputs

will be required.

The Society for Promotion of Wastelands Development is based on the recognition that there are many business corporations who wish to pursue social priorities effectively. The government, too, encourages such corporations by giving them tax exemptions for expenditure incurred on such activities. The business corporations have the skills of organization and management, which are crucial inputs for any programme in agro-forestry. The business skills will be linked with local-level agencies providing them services required for profit at the local level.

How far the new Society for Promotion of Wastelands Development will fulfil its promise of utilizing productively the "waste lands" of India with primary benefit to the poor is yet to be seen, but the enthusiasm for the basic concept is considerable by all concerned government, corporate sector, financial institutions, voluntary agencies and professionals.

Community-based Approach: Village Reconstruction Organization

The Village Reconstruction Organization (VRO), India, was registered under its present name in 1971, although Father Windey, its founder, began activities in Andhra Pradesh in 1969 after the disastrous cyclone in coastal Andhra. Previously Father Windey worked in one of the worst famines of Bihar in 1966/67. With the co-operation of local government Father Windey took up the reconstruction of ten of the poorest villages affected by disaster. Along with the rebuilding of entire villages he organized education and health services and incomegenerating activities for these villages. VRO also carried out socio-economic and land ownership surveys of rural communities affected by the cyclone.

Since 1969 VRO's activities have spread to several other states. The Orissa government invited Father Windey after major floods which wiped out hundreds of villages. VRO's experience is rooted in a systematic endeavour to press for deep-reaching changes and relatively more permanent improvements after natural disasters - and the Indian subcontinent is not short of these. It has projects in about 150 villages, largely in remote areas where various aspects of cumulative poverty are found together. VRO has a professional staff of 300 consisting of graduates in various disciplines, architects, engineers, nurses, doctors, etc.

Before a village is taken up for reconstruction, the village

community has to give demonstrable evidence of working together as a community. The villagers may work together on a well, a village road, a community woodlot, or on some other community asset. After the community has demonstrated its ability to work together, a formal document is signed between VRO and every member of the community (thumb impressions of 80-100 villagers) agreeing to contribute labour and to abide by other agreed conditions of working and living together. A village council is formed consisting of five men, four women and four of the youth of the village. The council manages the reconstruction of the village, plants trees along the village road, and later initiates developmental activities necessary to the village.

Only recently has Father Windey realized the socioeconomic implications of social and agro-forestry for the rural poor. With the existing infrastructure of the VRO Council, consisting of village leaders, and the village council, consisting of local people, VRO has planned nurseries, roadside plantations, woodlots and related agroforestry projects. In its training centre it is training villagelevel workers in starting nurseries, soil testing, managing seed farms, etc.

VRO has a community-based participatory structure. Discussion at meetings is free and easy. Decisions are not made by experts, although experts are consulted, but by the village council taking into account local needs and conditions. What VRO is able to achieve is a good fit between programme objectives, needs of the beneficiaries, and the capacity of the assisting organization.

There are many voluntary agencies working with communities of poor- helping them to organize, to articulate their needs as they themselves perceive them, and to help themselves. The various voluntary agencies in the Chipko movement are outstanding examples of participative approaches to helping the rural poor.

Conclusions

A wealth of information and experience was presented in the various papers reviewed. Some major issues of social, economic and institutional structures have been examined in relation to social and agro-forestry projects as they affect the rural poor. Through the cases and incidents discussed we have been able to glimpse the anger and anguish of the poor and disadvantaged, including women, when policies and programmes were formulated on assumptions which were far from the needs of the so-called beneficiaries. We have shown that beneficiaries need to be clearly

defined not merely as village communities. but as rich and poor farmers, men and women. and perhaps other significant categories relevant to local conditions. As professionals and experts we must realize that we, too, have our own special ways of perceiving. defining and creating reality. We begin to understand more meaningfully Humpty Dumpty's statement to Alice, in Alice through the Looking Glass:

"When I use a word," Humpty Dumpty said in a rather scornful voice, "it means what I choose it to mean - neither more nor less." "The question is", said Alice, "whether you can make words mean so many different things." "The question is". said Humpty Dumpty, "which is to be the master- that's all?"

We realized, as Humpty Dumpty did, the power inherent in the right to define a situation.

We have looked at institutional structures, which were "topdown," and "bottom-up," and also two- or three-tiered structures which linked local institutions with strong central services and inputs for the benefit and profit of the local groups. We realize the importance of innovative structures and of management systems for productive utilization of "wasted" resources - whether in land, water, or human beings.

We would like to end the paper by two quotations which sum up the problems of agro-forestry and the rural poor:

Neat and tidy packages prepared by experts to describe the appropriate future energy mix will avail us little unless they are economically significant and socially and culturally acceptable to the people asked to use them. - Soedjatmoko.

We have no power to talk in front of the rich, like the Chairman. We are afraid of them. We are always looked down upon and scolded. So we never know what they are writing and doing. - A landless labourer in Bangladesh.

References

Bordia, A. 1979. Indian Journal of Adult Education.

Gupta, T. 1979. Some Financial and Natural Resource Managements of Commercial Cultivation of Irrigated Eucalyptus in Gujarat, India. Indian Joumal of Forestry, 2 (2): 118-137.

Hoskins, M.W 1982. Observations on Indigenous and Modern

Agro-Forestry Activities in West Africa. Paper presented to the United Nations University Workshop on Problems of Agro-Forestry, Freiburg, June 1982.

Karamchandani, K.P 1981. Gujarat Social Forestry Programme: A Case Study.

Paul, J C N. and Dias, C.J. In press.

Discussion

In summarizing her paper Dr. Chowdry stressed three points: First, that generally there has been a "top-down" approach to agro-forestry projects. Planners approach a target population with preconceived notions of what they believe is best for the population. The result is failure. What is necessary is a "bottom-up" approach - finding out from the beneficiaries what their needs are and, thereafter, formulating programmes to meet those needs. Second, she challenged the competence of bureaucratic ("governmental"} organizations to meet needs in that they were characterized by inflexibility, working to rule, and reluctance to allow for popular participation. She asked whether one should not also consider voluntary ("nongovernmental") organizations as the main channels of assistance. While government, then, would be concerned mainly with financial assistance and policy formulation, voluntary organizations would mediate between the beneficiaries and government. Third, Dr. Chowdry pointed out that most programmes did not address the weaker ("disadvantaged"} segments of the population who needed assistance most - women, the poor. This was largely because these segments were ignorant about programmes, were denied access to them, and the groups were not in a position to protest. The speaker suggested the need for policies and strategies which involved women and other disadvantaged groups.

Discussion focused on four issues:

Bureaucratic institutions. Should Forestry Departments be abolished? Could they be made more flexible? Why was it that bureaucracies found it so difficult to be peopleoriented? On the other hand voluntary organizations appeared to interact more easily with people. It was suggested that the advantage of voluntary organizations could stem from a lack of vested interests. Most of the participants disagreed with this and contended that voluntary associations could equally develop vested interests.

Co-ordination. As with the previous topic, there was no resolution of agreed perceptions of the lack of, and need for, co-ordination. Is there a need for new institutions to deal with agro-forestry? Some speakers noted that the main bottle-necks to co-ordination existed at the middle levels where officials were particularly concerned with career prospects and protection of their own "empires."

Approaches. There was general consensus that neither a "top-down" approach nor a "bottom-up" approach alone would suffice to make a programme successful. On the one hand the "top-down" approach would fail because it was unrelated to local needs, priorities and resources; on the other, a "bottom-up" approach could fail if technical parameters were not considered. What is needed is a mix of both approaches.

Motivation. An element essential for the success of agroforestry programmes was the ability to motivate participants. Numerous examples were cited of programmes that utilized religious or philosophical principles to successfully motivate change. In effect, it was agreed that incentives to participate were not confined to financial incentives. It was agreed that there were two common components of success in the examples cited: trust and flexibility.

Other issues touched upon were the need for examination of communications techniques and, most important, whether the questions raised were peculiar to agro-forestry or whether they were also common to other types of projects - say, rural development.

One of the speakers concluded with the important recommmendation that future similar conferences should include participants from other disciplines and from among decision-makers (in government, from planning bodies). This would result both in a cross-fertilization of ideas (rather than only an affirmation by the already converted) and a means of influencing policy.

Continue

Some tenurial and legal aspects of agro-forestry

S. Kolade Adeyoju

Two major types of poverty exist in most developing countries: urban and rural. Urban poverty is largely the concern of the socio-economic and political experts. However, the causes of urban

decay are not altogether unrelated to rural poverty, which is far more profound in its setting and complexity. Fortunately, however, because of low population density as well as poor infrastructural development, rural affairs are generally more amenable to the application of legal instruments than are urban questions.

Over the last eight or ten years, agro-forestry has been broadly accepted as a major strategy for alleviating rural poverty. While there is an increasing literature on the characteristics of agro-forestry and the policies to be adopted in its implementation, the appropriate legal framework has yet to be clearly defined. Although FAO (1978) and Chowdry (19821 have outlined the relevant institutional components of agro-forestry, these synopses do not include indications of the legislation needed. Indeed, it is hardly an easy task to do this because of the innumerable combinations of activities relevant to agroforestry. However, if we view it as a multiple land reform strategy, then we should be able to identify the land use practices which are obstacles to agro-forestry and also to make some suggestions about the set of laws and regulations needed to enhance its productivity. Thus the way in which land is held, inherited, acquired or disposed of, as well as the conditions enabling the farmer to transfer his land from agriculture to forestry or vice versa, or to make combinations of both from time to time, are the main concern of this paper.

Land Tenure and Agro-forestry Development

In all countries the process of agricultural production takes place within an institutional matrix. Within this matrix, the form of land tenure exerts a profound influence on the level and efficiency of agricultural production. It follows therefore that the land tenure system in any country tends to freeze the processes of agricultural production in their existing form. Similarly, the extent of agro-forestry and the involvement of local farmers are directly related to the flexibility or otherwise of the prevailing form of land tenure

For instance, in a society based predominantly on hunting and food gathering - a primitive form of agrosilvopastoralism - individuals attach considerable importance to the land. Man himself makes the minimum contribution to development in these circumstances, although his contribution may include eliminating infestations by insects and preventing depredations by wild animals. In this situation, the land as an input contributes about 70-80 per cent to agricultural development. The minimal contribution of man is matched by the informality that he initially

attaches to arrangements for the utilization of land. These arrangements or working rules establish the patterns or modus operandi which all members of the community implicitly or explicitly agree to follow as each individual establishes rights of use over particular areas of land. In the African context, these arrangements have become customs or traditions so that we speak of the customary or traditional land tenure system.

As agriculture is the occupation of the majority of the population of developing countries any programme of development should take into full consideration the institutional aspects of the countries' agrarian structure. The land tenure system is an integral part of this and exists in several forms as shown in fig. 1. It is the family, existing as a corporate body, that has rights of "absolute" ownership in land under customary tenure arrangements. The head of the family ensures security of individual's rights over land through the exercise of rights of management and control as he acknowledges the opinions of other elder members of the family. On the whole, these systems of land tenure are not conducive to plantation agriculture let alone agro-forestry. The reason is that forestry practices are alien to traditional farming. It is no surprise therefore that the Nigerian First Developement Plan, 1962-68, recognizes that "traditional farming methods and systems of land tenure inhibit an extensive use of land for farming." For an extraneous enterprise such as forestry or agro-forestry, the implications may be quite considerable.

Again, the problem of land tenure was succinctly highlighted in the Second Nigerian Development Plan 1970-74. The authors of the plan recognized that "the prevailing land tenure system in the country sometimes hinders agricultural development . . . Ownership and control of food-crop land by individuals tend to be transitory . . . As a result of the system of inheritance, land owned by individuals or extended families also tend to become fragmented and scattered . . . If Nigeria's agriculture is then to develop very rapidly and have the desired impact on the standard of living, there must be reform in the system of land tenure." As this situation is not unique to Nigeria, the relevant solutions may, of course, not be dissimilar in other countries. Therefore if considered from the agro-forestry point of view, our concern with land is in its use and maintenance. Similarly, from the point of view of the farmer as an economic entrepreneur, the concern also focuses on ownership and other tenurial aspects of land.

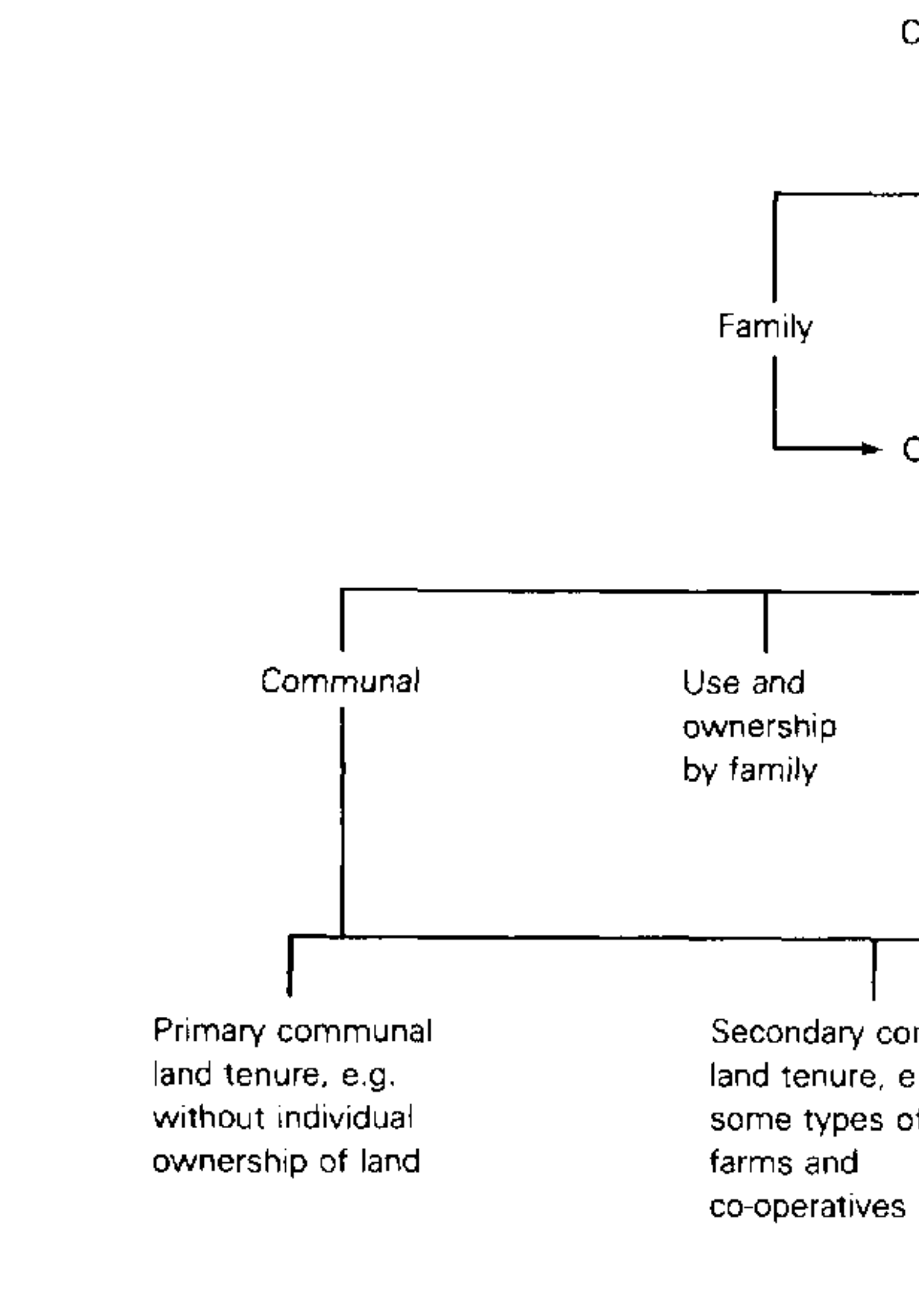
Family
Communal
Use and ownership by family
Primary communal land tenure, e.g. without individual ownership of land
Secondary co
land tenure, e
some types o
farms and
co-operatives

FIG. 1. Main Forms of Rural Land Tenure

Forest Land Tenures and Agro-forestry

Ten types of forest land tenures have been identified (Adeyoju 1976). Table 1 is a summary of the various tenurial trends and attributes. The remarks for each tenure are largely indicative of the improvement potential. Many of these estates have unsettled tenure and are therefore prone to frequent use transfers. For instance, under types 2, 4, 5 and 10 it should be possible to introduce agro-forestry as a catalyst for tenurial stability.

Considering two factors of land tenure policy - economic efficiency and social progress - Famoriyo (1979) noted that the contribution of agricultural production to Nigerian development is very low. This is because agricultural land is "wasted" and mismanaged. Undoubtedly there is a need to promote more highly efficient utilization of resources through a land tenure policy. This need may be fulfilled by improvements in technology, creating flexibility in the land tenure system, taking adequate measures to prevent fragmentation and consolidating already fragmented areas. These tenurial improvements will be encouraged by agroforestry since this system strongly promotes a more sedentary type of farming than is traditionally practiced.

TABLE 1. Summary of Tropical Forest Tenure Attributes

Type of Tenure	de jure Ownership	Origin or Reason of Tenure	de facto Control	Major Eff of Tenure
1. State forest/ forest reserve	State	To ensure minimum land basis for government policies desirable for	Forest services	Governm freehold
2. Communal forest	Local community	To attempt to "modernize" traditional tenures	Forest service/	Restrictio use, but reven retained owner
3. Protection forest	Any	To ensure beneficial forest influences owner	Forest service/ declaration	Restrictio uses contrary t purpose c

				ecological objectives
4. Protected forest	Any	To stabilize the form of land use	Owner/ forest service	Restrictio conversio other land uses
5. Protected forest tree species	Individual valuable trees	To control utilization of removal	Owner	Restrictio
6. Private forest	Individual	Extension of ownership concepts to forest land, usually in free market economies	Owner	Individua
7. Reclaimed forest land	State	Development of marginal "no man's land" imperatives	Forest service	Governm freehold
8. Timber utilization contract	State/ community	To obtain revenue with minimum management	Grantee/ forest service	Tempora by grantee u forest service co
9. Timber rights	Local community	To ensure raw material provision to industry	Grantee/ forest service	Tempora by grantee u forestry service co
10. Rights of usage	State/ community	Attempt by state to recognize certain elements of traditional tenure in lands	Forest service groups	Specified secondary use allowe local appreciat local communi

Guidelines for Agro-forestry Land Tenures

What has been outlined in the last two sections relates to land tenure under two distinct production regimes agriculture and forestry. Because agro-forestry is a hybrid of the two, and also because planned and systematic agroforestry is only just emerging, no really pertinent forms of tenure can readily be cited. Therefore the purpose of this section is to highlight certain preconditions for tenures, which will be appropriate to agro-forestry.

General Considerations

Flexibility
Flexibility as an objective in land tenure implies that opportunities exist for movement along the agricultural ladder. It means introducing a tenure system which creates opportunities for industrious labourers to become farmers and for ambitious customary tenant farmers to acquire absolute interests in land. More important, it means that whoever wants to practice mixed farming including both specific forest crops and annuals will have authorization and legal support to continue his enterprise until the forest crops are due for hamest. Access to these opportunities should not be hindered.

Consequently, the policy that is envisaged should include provisions for facilities such as credit for capital formation, opportunity to market crops at reasonable prices, and the creation of adequate infrastructures. A system of land tenure that is flexible is never static. Rather, it is dynamic and it changes in accordance with the new social and economic features of the population for whom it is designed.

At present, those examples of agro-forestry that have, in general, been successful have been reported mainly from forest estates in Thailand, the Philippines and Nigeria. In the vast agricultural lands of tropical Africa, agro-forestry has yet to make a breakthrough. The reason is due largely to the inflexible system of land tenure as well as its attendant insecurity. Since the security of rights in land is crucial to agricultural development, measures to preserve such security should constitute the principal element of agro-forestry land tenure. Both accessibility to land and security of interests therein are closely related and should be the core of an agro-forestry land policy. We may therefore agree with Uchendu (1971) that the question of accessibility constitutes "the irreducible minimum criterion demanded for a productive tenure system." This condition is indisputably fundamental to the adoption of agro-forestry by peasant farmers.

Investment in land
The security of interests in land encourages the farmer to make necessary investments. In other words, provision of security creates the opportunity for the farmer to raise the status of agriculture from a susbistence base to one oriented towards investment. Agroforestry is far more capital-demanding than traditional agriculture and thus would constitute a major investment in rural areas.

The most important social objective of a land tenure policy is to facilitate the development of a well-integrated rural community. The trends in agro-forestry are strongly directed towards the development of prosperous rural communities, but again these efforts are localized within consolidated forest estates. Outside the forest estate, necessary incentives should be given to agro-forestry farmers whose willing participation will promote economic integration.

Conflicts and Complementary Effects between Objectives

In attempting to incorporate agro-forestry objectives within the frame of land tenure policy and legislation, it should be realized that objectives may conflict with each other, or, on the other hand, may be mutually complementary. For instance, a close relationship exists between security of tenure and rational conservation of soil in that a customary tenant farmer whose stay on the farm is short does not have a long-term interest in the land. Also a complementary relationship exists between the objectives of flexibility and security in land tenure. Where a land tenure system is sufficiently flexible to accommodate the more efficient methods made possible by progress in agriculture, it is only farmers whose interest in the land is secure and sustainable who will be inclined to adopt such methods.

Even between the two broad goals of economic efficiency and social progress conflicts may arise. For instance, where a political system is oriented towards eliminating the traditional system of agriculture in order to build a new and, it is hoped, more stable system, social progress may be hindered although the economic efficiency of agriculture may be improved. However, agro-forestry as a production system is not intended to eliminate, but rather to ameliorate and, where possible, transform traditional wasteful land use practices. Again it should be emphasized that in the execution of well planned agro-forestry projects, not only are the conflicts that may arise between the goals of economic efficiency and social progress less sharp, but it is often possible to achieve a satisfactory

compromise between these goals, or even to make some progress in reaching both.

Legal Reforms to Remove Anomalies

Most of the forms of tenure listed in fig. 1 and table 1 coexist within each developing country. Suffice it to say that most of these forms of tenure are not easily adaptable to agro-forestry. Urgent efforts should therefore be made to redefine and/or codify such conditions and situations as:

- The role of forest reserves particularly with regard to their currently exclusive or restrictive use;
- The type of land usable for agro-forestry and the variety of crops permissible;
- Derivation factors for the sharing of revenue from individual economic trees on farmlands;
- The role of forest guards (protection staff) with regard to their activities outside the forest estate;
- Mandatory technical assistance that should be provided by both the agriculture and forestry departments to agro-foresters; and
- Inheritance of agroforestry lands.

Development Horizon

In the past, the main preoccupation of land tenure was to guarantee succession to rights in land for food production per se. Therefore in that context forestry tenure was alien. In modern times, however, the need to accelerate agricultural production from the vastly depleted soils and for the enlarged population has made land tenure a national rather than a local issue. In the wake of new programmes to increase food production the sacrosant status of forestry tenure is being persistently attacked. Indeed, considerable dereservation has taken place in many places for plantation agriculture of one type or another.

However, agriculture and forestry still remain distinct landuse regimes with their own relevant laws and tenurial arrangements. The food situation in many countries as well as their festering economic and social problems demand that the rigidly separate forms of tenure applied to land used for agriculture, forestry and livestock should be tempered by the startling realities of the day. In a situation in which the forest service is patently locking up land the vulnerability of forest tenure is self-evident. Impetus towards support for forestry will come from a population that is

either visibly benefiting from forest management programmes or is less dependent on the agricultural economy. Agro-forestry is undeniably a key programme for mass participation and rural development (Adeyoju 1978), and therefore an indispensable tenurial ingredient. In this connection it should be noted that the real barriers to state action over forest land tenure are political and economic, not legal.

Again an interesting development has been observed in parts of Nigeria. Through the various rural forestry projects the loss of forest land to agriculture has been slightly compensated for by the steadily increasing number of converts to farm forestry. During the last decade the shortages of such produce as wrapping leaves, poles and firewood (which are critical to the domestic and food preparation habits of certain groups of Nigerians), have created a favourable atmosphere for private ownership of fairly large woodlots, particularly in the savannah zone. The thriving small forestry business of these private citizens (however few in number) refutes the previously held maxim that large tracts of forests are necessarily required to support processing plants. These rural forestry projects are generally devoid of tenurial problems in the short run, although the questions of inheritance and of succeeding rotations are still unsettled.

Projects of this type should not be imposed on land held under existing forms of tenure. At present, because the main objective is to satisfy the needs and preferences of local population, the projects are being executed without turmoil or upheavals. Therefore emphasis should be placed on the set of laws and regulations essential to successful agro-forestry in order to dispel the notion that the new efforts are an extension of the old-fashioned forest reservation policy.

If public participation is viewed as a means of mobilizing talent, expertise and special knowledge relevant to agroforestry, then such public involvement is completely consistent with the optimization of tenurial functions which land-use projects are expected to foster. Consequently, in order to obtain good tenurial adjustments and appropriate legislation, all affected parties need to be involved in both preliminary discussions and ultimate decisions.

To summarize. we have attempted as far as we can, to apply the theory of political economy to what has been, in the past, the mutually discriminating nature of agriculture and forestry. In order to develop a coherent philosophy of rural land management, of which agro-forestry is an important part, we should identify and

stress the significant similarities and common objectives between forestry and all the other land use sectors. This approach should lead to a clarification of the tenurial options for development and the basis for legislation.

While we have distinguished between the traditional forestry and agricultural regimes, our intention is largely to draw attention to the problem of evolving the appropriate institutional framework for agro-forestry. Much additional work is needed in order to better delineate the variety of traditional land tenures and existing legislation on the one hand, and the requirements of agro-forestry on the other, as well as the means of obtaining the required information. This is a challenge to foresters, agriculturist and other specialists.

References

Adeyoju, S. Kolade. 1976. Land Tenure Problems and Tropical Forestry Development. FAO, Rome, 36 pp. FO FDT/76/5 (b). -. 1978. "People's Participation in Forestry for Local Community Development." Position Paper 1, 8th World

Forestry Congress, Jakarta, Indonesia, 24 pp. FRC/1-10. Anon. 1962. National Development Plan, 1962 68. The Federal Ministry of Economic Development, Lagos
- 1970. Second National Development Plan 1970-74. Federal Ministry of Economic Development and Reconstruction, Lagos.

Chowdry, K. 1982. Agro-forestry The Rural Poor and the Institutional Structures Position Paper, Workshop on Agro-forestry, Freiburg, 31 May - 5 June.

Famoriyo, S. 1979. Land Tenure and Agricultural Development in Nigeria. The Nigerian Institute of Social and Economic Research, Ibadan, 146 pp.

FAO. 1978. Forestry for Rural Communities. Rome, 56 pp.

Uchendu, V.C. 1971. The Conflict Between National Land Policies and Local Sovereignty Over Land in Tropical Africa. Seminar on Problems of Land Tenure in African Development held at the Afrika Studie Centrum, Leiden, Holland, 13-17 December.

Discussion

Five main aspects were discussed as follows:

Definition of "Agro-forestry" in order to focus on legal problems
Participants differed in the relative importance given to agriculture, forestry, livestock or general good land use, but laws relating to any of these will affect agroforestry. The exact role of cattle and small stock needs to be established. When are they beneficial and when destructive? What are local attitudes and regulations and government policy regarding livestock? How do tenure regulations relate to which is the best crop to interplant? Some crops such as potatoes and corn may have adverse effects on soil erosion. Fish-farming is another subject which may be integrated into agro-forestry, and will have legal aspects.

Laws protecting whose rights?
There are many conflicting rights - of government, Iand-owners, landless peasants, transhumants and other minority groups ("tribals") some of whom practice shifting cultivation. The latter's rights are often neglected or misunderstood and in some areas (e.g. India) this may affect thousands of desperate people. To what extent do the rights stress land use - or product use? There is an important distinction between rights of ownership and rights of use. "Communal rights" still exist in some areas, but are often highly adaptive to new circumstances, e.g. cocoa in Ghana led to land ownership using modified traditional forms; the mailo system in Uganda promoted cash-crops.

What laws?
There is a wide range of types of law, including national laws, regional or local regulations, and traditional laws regarding rights to land and to trees. The right to trees may not include the right to the land on which they grow. Are there too many laws, as was suggested in Colombia? Or is it inevitable that complex situations necessitate complex laws? What is important is that people have knowledge of the laws, and that laws support effective landuse planning. Some laws (e.g. colonization in Brazil) support "land-improvement" which may mean extensive tree-clearing, other laws over-protect trees, even forbidding a land-owner to fell certain species unless he pays high fees to the government.

Enforcement
Examples were provided from many countries of forest laws not being enforced, from shortage of officials. because people were not persuaded that laws were needed, or because it was easy to bribe forestry officials to turn a blind eye. Many other laws (on agrarian reform, land tenure, tax, marketing) affect agro-forestry, also. "Regulation is inimical to extension." If true, should forest regulatory activities (fees, permits. prosecution, all policing) be

separated from educational and extension work?

What are the consequences of laws? Many laws are enacted without a thorough consideration of whether they are enforceable, or appropriate, or of what the benefits and costs will be - and to which groups. It is desirable (where countries have the capacity) to analyse the socioeconomic impacts of proposed legislation before making it into law.

Other Points from Discussion

- It was apparent that although specific situations are very diverse, there are certain universal legal principles which can be used (with appropriate modification) in analysing all cases.
- In considering legal aspects of agro-forestry, we should take a wide view and emphasize an integrated rural development approach, including all other relevant social and economic activities and institutions.
- An important legal aspect relates to the view from below, the knowledge, institutions and perceptions of the local people. Before introducing new laws, officials should understand the existing legal institutions and customs which govern land use rights and the organization of the means of production. In many cases it will be found that traditional institutions are foundering under intense pressures (population increase, land shortage). Indigenous technical knowledge, which includes an extensive knowledge of local vegetation and its properties, should also be taken into account: too often this is overlooked. For instance exotic species are often introduced when indigenous species may be more suitable. Before introducing new legal ways of resolving conflicts, existing institutions and methods should be examined to see if they can be modified and used. Ironically, success in agro-forestry ventures may well lead to an increase in conflict and litigation, as people scramble for new opportunities.
- Bureaucracy-any laws must take into account the existing bureaucratic structure, especially the hierarchy and responsibilities of different ministries. Where inter-ministry co-operation is lacking (a common situation in many vertically integrated ministries) the chance of new laws being introduced and effectively enforced is low.
- Information clearing house: finally, several

participants stressed the need for a more effective means of communication, so that we can learn from each other's experiments and errors. Both FAO and ICRAF are working on this problem.

Continue

Education for agro-forestry

Peter A. Huxley

Introduction

In introducing this subject I am making a distinction between "education" and "training" whereby the latter refers to short, or relatively short-term studies of general or particular practical aspects undertaken in order to achieve a higher level of technical or professional skill, and education refers to a broader, longer-term approach to the acquisition of knowledge, techniques and methods, and the ability to utilize them, and which is undertaken in order to achieve a technical or professional qualification. These two definitions clearly overlap and early on we may make several assumptions about the kind of "education" we are discussing. The first is that it is essentially "education for capability," i.e. embracing not only the acquisition of knowledge and the capacity to analyse it (scholarship), but also the development of creative and useful skills and the competence to undertake tasks, and working abilities (capability). The second assumption is that the outcome of such education is going to be, in nearly all cases, devoted to contributing to national development in some way, as well as providing a livelihood for the person who has been so educated.

Because agro-forestry is so relevant to the development needs of tropical and sub-tropical countries the growth of agro-forestry education is likely to proceed even faster in the developing world than elsewhere. There is another factor which may promote this, the fact that many institutes of education in developing countries are less affected by historical constraints and rigid organization, so that they may benefit by a greater infrastructural flexibility. At least, it is to be hoped that this is so! In addressing the possibilities for agro-forestry education I feel that there is room for a very wide range of informed opinion and considered views. In preparing this paper I have, therefore, set some ideas down more in the form of a structure for discussion than as a formal paper. See also Contant (1979), Roche and Cooper (1980).

1. Do we Actually Need to Set up New Programmers or Courses to Teach a Subject Called "Agro-forestry"?

As we all know, to give a precise description of the limits of agro-forestry is not easy and the compilation of definitions for their own sake is certainly a sterile occupation. Nevertheless, it behoves us to know well the nature of the subject we want to teach and a glance at the definitions listed in Appendix 1 shows very clearly that we are dealing, whatever the differences in emphasis might be, with a range of aspects - technical, social and economical, and obviously dynamic - concerned with particular forms of land use systems: the operative word being "systems." We therefore have to teach about systems in a way that not only describes them, but uncovers and analyses the interactions of the system components, understands the processes, and so facilitates an interpretive, quantitative and objective assessment of the characteristics (e.g. productivity, sustainability) of any one kind of system that has to be assessed - a way which also promotes an easy and effective comparison between systems (whether they are classified as agro-forestry, agriculture, forestry or range management) and also one that encourages the promotion of new ideas and developments.

With this in mind we can return to the question at the head of this section. Thus to whatever extent bits and pieces relevant to agro-forestry may be taught- and this issue is raised again in the next section - it cannot satisfy the full conceptualization of the subject, or be of more than limited practical use in producing professional personnel capable of handling real practical development or research situations, if it deals with only some part or parts of what is a system-oriented subject. Bringing agro-forestry situations and examples into courses on soil, plant or environmental studies; commenting in a descriptive way on case studies of land use which include agro-forestry examples in, say, geography courses; discussing the methodology of the economic analysis of multiple output, long-term land use systems; and mentioning agro-forestry examples in an agricultural course programme will all help promote the subject. But a fully comprehensive and integrative approach is needed if capable, operational personnel are to be produced.

Because it already exists in so many forms, and because the understanding of specific agro-forestry situations in the field includes such a highly integrative approach, agroforestry is really an attitude of mind in the first instance. The development of conceptual approaches, which then lead to practical implementation in constructive terms, is so firmly the objective of

educational programmed, nowadays, that the introduction of agroforestry programmes should present a very acceptable challenge. But the task should not be underrated. This is because our whole educational system relating to applied environmental science and land management has developed over the last hundred years or so in precisely the opposite direction. The so-called "pure" sciences (which themselves developed from the necessities and importunities of finding practical solutions to day-to-day problems), were paralleled by "applied" sciences and the technological application of the principles involved. This phase of educational development rapidly involved a fragmentation of subject areas as scientific research found the need for a greater analytical appreciation of the complexities inherent in the study of environmental situations, and the need for highly trained scientific manpower to explore and exploit them. This was followed by a period, up to a short while ago, of re-synthesis as it became apparent, with the rapid increase of knowledge about our environment that ensued, that certain "interfaces" between subject areas were, in their own right, equally vital. For example, in my own subject area "pure" botany led to "applied" or "agricultural" botany, which included specialist courses in plant pathology, plant breeding, plant physiology, etc. These developed even further relevance to practical situations as time went by; plant physiology became "crop" physiology for example, and then, in the re-synthesis phase, we had subjects such as crop-ecology, or pest management (as an addition to courses on applied entomology, plant pathology and weed control!. More recently, with the advent of systems theory, additional courses emphasizing the nature and scope of a holistic approach have added significantly to our appreciation of the need to examine and understand interrelationships in the management and improvement of land-use systems. But systems theory is a tool and the mere addition of courses on this subject, rather than basing the whole structure of a programme around the systems concept entirely, can fall short of promoting even a satisfactory mental capability (leaving aside for the moment the acquisition of skills) in those being educated in land management in one form or another. When we come to agro-forestry, the scope is so wide and the integrative nature of the subject so implicit, that my own view is that there is no really satisfactory way of teaching it without building a programme structure on the systems themselves - but more of this later.

Perhaps one example, of the many that could be given, will serve to elaborate the need to change attitudes through education. For many years land resource planners utilized schemes, developed

mainly in temperate countries, which have indicated a classification of land in terms of soil, climate, topography, etc. A further extension has been to extend these so as to indicate "land capability classifications". Until recently forestry enterprises related to timber production were in the main relegated to the poorer areas in most cases. Now that foresters and others are well aware that the so-called "secondary" forest products (fuelwood, fodder, food, etc.) are often of equal importance to timber, planting of forest plots on better land is quite in order. Thus this first attitude barrier is now largely being overcome, but there is still some way to go because, over large areas of the tropics and sub-tropics the producer, often working on very small plots, is concerned with selecting from the whole range of suitable and acceptable plant species those which can satisfy his basic needs. He is therefore interested in an appropriate mixture of plant species, some of which can be trees and shrubs (and also vines and palms, if appropriate). In fact trees and shrubs play an important role on so-called "farm" land throughout much of the tropics, but there is still a strong tendency to consider land capability in terms of agricultural or forestry enterprises, and not to evaluate the possibilities of agro-forestry. Until people are educated in the possibilities of agro-forestry land use systems and are able objectively to evaluate these against other existing possible forms of land use, it is difficult to see how matters will change to any extent.

I would unhesitatingly suggest, therefore, that we do need to teach agro-forestry as a specific subject in its own right.

See also Appendix 2, "Action Guidelines on Education in Agro-forestry."

2. To What Extent Is Agro-forestry already Being Taught?

The ready acceptance of agro-forestry as rational alternative land use systems, and the knowledge that trees and shrubs play a range of important roles in the landscape, has resulted in the initiation of agro-forestry courses of one kind or another all around the world. At ICRAF we are interested in collating information about institutes that are involved in agro-forestry or plan to be, and the actual course or programme structures and contents.

No one type of institute or department has the prerogative of teaching agro-forestry and, quite rightly, the subject is, or will shortly be, of active interest in faculties and departments of forestry, agriculture, horticulture, applied ecology, applied biology,

geography, environmental studies and resource planning, and probably others. However, not all have the necessary multidisciplinary staffing to do justice to the subject and many are, I suspect, dealing with the subject in a way which separates the components (plant aspects. soil aspects. economics. etc.).

Such subject-oriented classificatory structures may be helpful in ordering our thoughts about what has to be included in a technology programme but, I suggest, they are not the best way of setting about actually teaching it for the reasons that I have set out in the previous section. What has served as a reasonable division and subdivision of subject areas for the organization of scientific inquiry is not, necessarily, the best for an education programme, even if the material for teaching is most readily available in that form.

Certainly, the needs and objectives of different kinds of educational institutes or departments have to be looked into rather carefully, and it would be ill-advised to reach conclusions about this without a good deal more information and thought.

3. What Will Professional Agro-foresters Have to Do?

In theory there is no difficulty in seeing a wide range of opportunities for professionally trained agro-foresters as planners, developers and research workers, for example, and also, in a "secondary" capacity as teachers and extension operators, as well as trainers of both these groups. In practice, there may be some problems. This is because the question above really poses at least one other. For example, we have to be concerned in the education field not only with what part in national (and international) activities professional agro-foresters may play, but whether jobs and career structures are actually open to them at the present time. And, also, some attention has to be given to the infrastructural nature of the organizations within and between which they all have to work.

Although most governments have a ministry of environment and natural resources, or its equivalent, there are very different levels of co-ordination and collaboration with other involved ministries and government departments which may deal separately with agriculture, forestry, energy, livestock, etc. Even where there are inter-ministry coordinating bodies, problems can remain - not the least the effort needed to convert those who have been educated, and become experienced, in the conventional and separate disciplines of "Forestry" and "Agriculture", for example. Until

existing structures are re-modelled, or an adequate degree of change of both attitudes and infrastructural organization is achieved, these factors may tend to militate against either the recruitment of professional agro-foresters or their effective use.

Then again many universities and colleges involved with land development have faculties or departments still structured along conventional lines, i.e. department of forestry, agriculture and so on. For those who are going to study agro-forestry the institutional organization of subject areas into "schools" (e.g. school of environment studies, or school of land resource planning, etc.) may perhaps better facilitate the development of a highly integrative subject such as agro-forestry, and also utilize its concepts and practices to better advantage.

One important aspect of education programmes, as we all know, is not just to plan to keep up with the times with new types of programmed or courses, but to provide trained manpower for the development process in the number and types required, and at the time when they are needed and can be absorbed. Most of us here will see this need, but rather careful co-operation with national manpower development divisions may be more than usually a prerequisite for the development of agro-forestry education programmes in any particular country.

In listing some possible professional activities I have just briefly mentioned that of "extension." The functions of government (as well as non-government) organized assistance and control of producers, and the efficacy or otherwise of different approaches to extension, as well as the training needed to achieve competence in these, are outside the scope of this paper. However, I would like to suggest that the more refreshing approach to research in developing countries which we have seen coming about in the last decade could help to remove some of the burden of both transmitting and developing new ideas, methods and materials at the farm level. The key word here is "developing" as, more and more, both research objectives and the steps by which they are achieved, are now incorporating farmer participation. We are all only too well aware of some of the costly and time-wasting mistakes that have been made in the past when purely technical solutions to land use problems have been reached, in isolation, by researchers. The development of many more "on-farm" trials, in which the farmer himself can undertake the management, and at least help with the evaluation phases is now, fortunately, becoming much more commonplace. What is important to us here is that these kinds of activities are not only often more

relevant researchwise but they are, in themselves, extension exercises as well.

Because agro-forestry systems are so often very sitespecific there is a very considerable need to develop simple field research methodologies for evaluating both new components and processes (as well as new systems) together with the farmer, and in direct relation to his particular output requirements. Agro-forestry educational processes should certainly emphasize the knowledge, skills and techniques which will enable the recipient to take a full part in this new approach in the research-extension continuum.

In discussing professional education in agro-forestry we must consider not only higher-level but mid-level cadres. These might be expected to be more technology-oriented and to fill lower-level management and junior field research posts, for example. There is no less need for orientation in the systems approach, but we might start further back and try to distinguish between the actual technical skills needed for agro-forestry as distinct from agriculture or forestry. For the time being the practice of agro-forestry (planting, soil management, caring for crops and trees, harvesting, pest management, field procedures) will require only those basic skills which agricultural technologists or forestry technologists can, between them, provide. It may be only an expediency but, for the time being do we really need to do more than combine personnel trained in technologies through existing courses in agriculture, horticulture or forestry? This is an attractive proposition but perhaps basic skills are not enough. The successful application of technology implies a familiarization with the systems, or those being dealt with - the actual handling of particular species of multi-purpose trees, for example. So, although programmes designed to produce manpower fully capable of implementing agro-forestry projects in the field may for now draw on other forms of existing technical teaching quite heavily, some essential parts will still need to relate specifically to the components found in appropriate agroforestry systems. First of all, however, we have to gain an adequate technical knowledge of these - for example, much more information is needed about the management of multipurpose trees than we at present possess.

4. Is there a Case for Developing Agro-forestry Teaching from a "New" Angle?

This question really applies to higher-level professional education - more specifically to full degree programmes. In previous sections, arguments for a systems-oriented approach have been introduced

based on the very integrative nature of agro-forestry. These can be extended by two other factors: the time limitations in undertaking programmes which may try to cover both agricultural and forestry components, processes (and principles) in a conventional, course-structured way; and, related to this, the essential need, at this educational level, to treat as much material as possible "in depth" and at a suitable intellectual standard.

We might make two reasonable assumptions. The first, that it is quite unnecessary to cover everything - i.e. students of agro-forestry do not need to be taught to be both agriculturists and foresters. Indeed, I would go further and suggest that, in any first-degree course, filling the mind is a lot less important than training it, so that students of agro-forestry do not need, even at this level, to gain personal knowledge of every single aspect of agro-forestry (as defined in Appendix 1). The second assumption is that the acquisition of knowledge which is itself easily related to practical examples, and which is clearly part of a system (or subsystem), is an economical and effective way of educating for capability. This is because if at least some of the interactive aspects of that particular example can be appreciated (and by observing a practical situation this is made more likely) then the learner is able to relate specific technical knowledge (say the aetiology and epidemiology of a plant pathogen causing a crop disease) to its effects on the system as a whole (the financial costs of controlling it, or not; how labour and skill have to be organized, and so on). Because "teaching by example" is time-costly, its use emphasizes even more the need to take the first assumption to heart.

But I would go even further. And I believe that for an integrative subject of such enormous scope as agroforestry it could be extremely effective. Except perhaps in the first year of an agro-forestry degree programme, conventionally formulated course structures could well be dispensed with and their content, in the main, included as a well-prepared sequence of practical field exercises chosen to illustrate different kinds of systems (or parts of systems). To supplement the field practicals there would clearly need to be "satellite" exercises (lectures, library reading, laboratory practicals) but all with the purpose of elaborating the subject in relation to the system being examined. Ordinary courses on such subjects as "Soils," "Climate," "Plant Diseases," "Animal Husbandry." "Silviculture" would not occur in their usual form. Instead, their content would be included and combined in the field exercise with any necessary elaboration occurring through "satellite" teaching modules.

Such a programme starts in the field and works towards the fine details. Historically, we have tended to treat landuse/land-management subjects the other way round, thereby arriving at the value of a subject to a whole system at the end rather than the beginning. Fig. 1 (taken from a previous paper) gives a brief structural indication of what is intended.

There are two major constraints to the efficient implementation of such a scheme: its dependence on an extremely well-ordered and carefully integrated series of practical field exercises, which would have to have a high degree of reliability in actual operation; and the lack of continuity of staffing which is still a problem in many educational institutes in developing countries. Both can be, at least to some extent, overcome in a similar way.

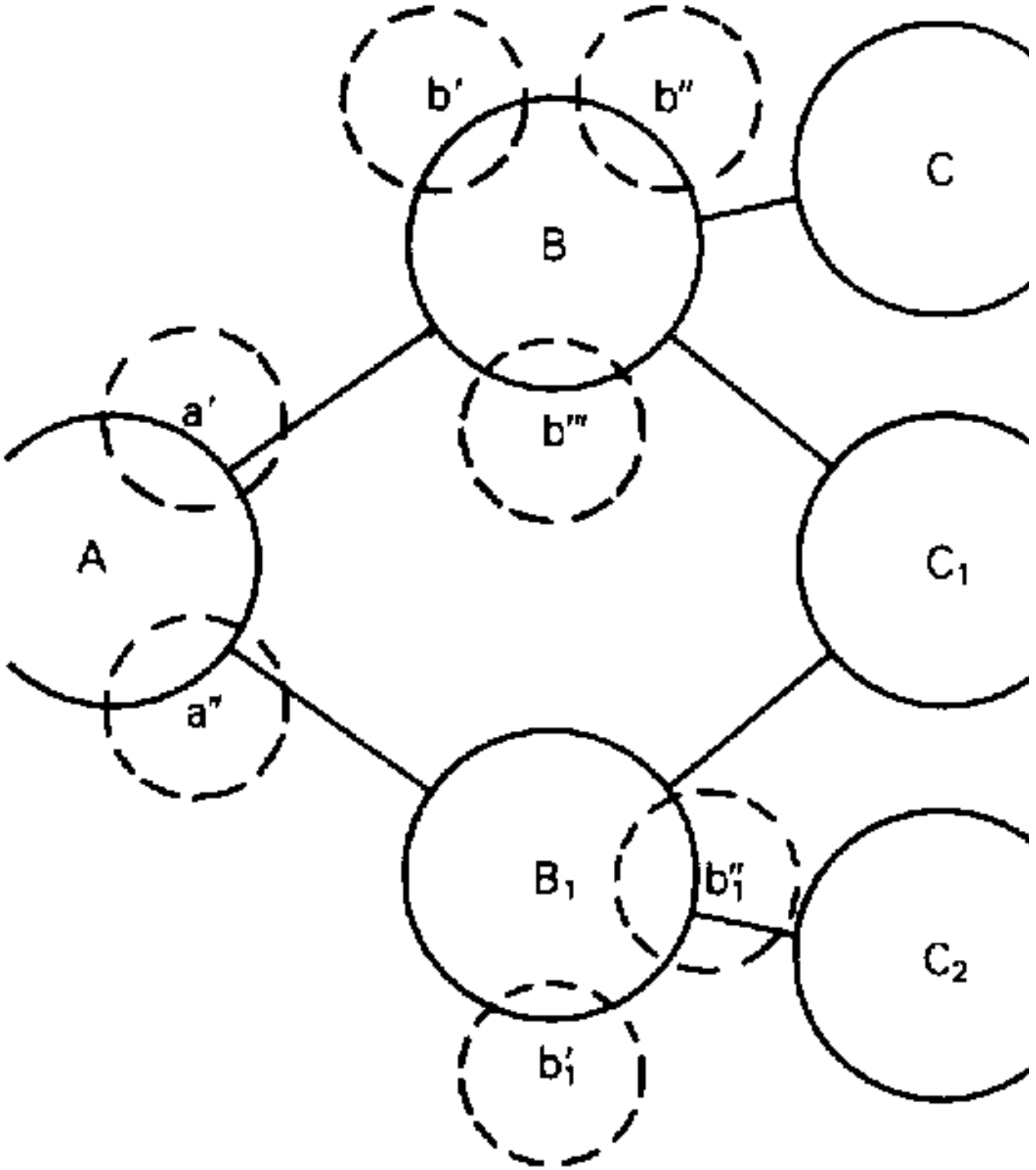

FIG. 1. Skeletal outline intended to present only a general idea of a course (programme) structure for agro-forestry at degree level. A, B and B., C, C, and C2, etc., are practical exercises chosen both to present a logical sequence and to contain the necessary elements of what would normally be given in separate courses (soils, climate, silviculture, etc.). "Satellite" exercises accompany these as necessary to supplement them with lectures, seminars, laboratory practices, etc. (in some cases preceding or following the main exercise). (Source: P.A. Huxley, 1979.)

Although a poor substitute, well documented (and illustrated) "case" studies of agro-forestry systems,' complete with data, might be used to replace some "homegrown" field examples; or at least kept in reserve in case of accidents. The question of maintaining effective continuity in teaching such programmes might be answered by having the main structure of the programme designed by a group of experts. It could then be provided as a set of elaborated guidelines, complete with suggestions for practical examples and teaching aids, to whatever faculties or institutes required it. There would still be the task of arranging the practicals, but a set of manuals on what to look for, and what to measure, etc., could assist even here. There may be a feeling of revulsion against such a proposal, particularly as lecturers and teachers are usually very independently minded people who wish to teach their own thing in their own way. Sufficient scope for the inclusion of local initiatives within the main framework would, clearly, be essential.

With regard to shorter programmes (one-year diplomas, M.Sc., etc.) there is probably less reason for innovation but, even here, the underlying need to understand and appreciate the highly interrelated parts of an agro-forestry system is still a mandatory feature.

See also Huxley (1976a, 1976b, 1979).

5. What Has to be Done?

Changes in education are usually brought about only very slowly, whereas human response to and realization of new understandings and initiatives can be remarkably rapid (environmental conservation, renewable energy. agroforestry). So although it is accepted that the pace and quality of progress in any aspect of national development is highly dependent on a sufficiency of correctly and adequately trained manpower, it is unlikely that professionally trained agro-foresters will be forthcoming in anything like adequate numbers for some time to come. What is to be done in the meantime? Certainly, as a stopgap, agro-forestry course packages can be included in all kinds of other educational programmes and ICRAF's Training and Education Programme does include a place for the preparation of such a course "package," when resources allow! Retraining of graduates through short-term diploma or M.Sc. courses will not be a difficult thing to start, and this is already being done at several institutes. But this meeting and, at greater length, the forthcoming Workshop on Professional Education in Agro-forestry, will, no doubt, wish to address this question.

If we are going to teach we have to have some materials to teach with. There is an urgent need to organize the collection, assessment, re-formulation and exchange of appropriate teaching materials for agro-forestry courses. A growing number of publications on agro-forestry is now appearing in the scientific press (including a new journal devoted to it, Agro-forestry Systems), and other journals. ICRAF is contributing, along with many other organizations, institutes and faculties; and much of this material can be useful in teaching (for example, see ICRAF's latest "Publication List" and bibliographies from different sources). Existing agro-forestry field projects can provide case study materials of considerable value, and this source can be expected to grow rapidly over the next few years. ICRAF's own programme allows for the preparation of five major separate reviews covering particular areas of agro-forestry (agro-forestry and food, renewable energy, animals, soils and social and economic aspects). There is also to be a "Science and Practice of Agro-forestry" series of small booklets (about 100 pages) each concerned with a particular aspect of agro-forestry research, development or technology.

In a few years, through the combined efforts of those involved and interested, the "literature gap" will at least be partially filled, and it is to be hoped that much of the material to come will be concerned with detailed factual accounts and experimental data.

Perhaps the greatest challenge to be faced will be the changes in attitudes among educators themselves, along with the necessary infrastructural modifications which will be needed even to absorb agro-forestry as a part of existing curricula let alone set it up as a programme on its own.

Appendix 1. Agro-forestry Defined

Agro-forestry is an age-old practice for which modern concepts are only now being developed, so it is not surprising to find that some agricultural and horticultural systems might appear to overlap into agro-forestry (or viceversa). Indeed, one might define agro-forestry as that which is not commonly accepted as agriculture, horticulture or forestry! However, because it is difficult to be precise about the terms "agriculture," "horticulture" and "forestry," a definition is needed to give the term "agro-forestry" some commonly accepted meaning. Its precision will depend on how involved it becomes: the meaning of "agro-forestry" can be stated in a number of ways, depending on the level of discrimination required by those being addressed.

This subject was debated briefly at a conference "International Co-operation in Agro-forestry" - convened by ICRAF in Nairobi, 16-22 July 1979. Some of the suggestions, together with the definition previously used by ICRAF, are given below.

A very simple statement may often be adequate - despite its lack of precision. For example:

Agro-forestry is a form of land use that successfully satisfies the need of the crop farmer, forester and/or stock farmer. - Kabelo Gilbert Mafura, Ministry of Agriculture, Lesotho.

Agro-forestry denotes all activities in land utilization where the production of food goes hand-in-hand with the production of wood (in its widest sense). Soekiman Atmosoedarjo, State Forest Corporation, Indonesia.

or

Agro-forestry involves the combination of trees in a land-use system in space or time with either crops or animals production, or both, in order to achieve a stable production system for the benefit of rural population. - G. Budowski, Centro Agronomico Tropical de Investigacion y Enzenanza, Costa Rica.

More ideas are brought in by the following:

Agro-forestry is a sound land-use system that integrates trees with crops and/or animals so as to get higher productivity, more economic returns, and better social benefits on sustained basis, than are obtainable from monoculture on the same unit of land. Even for marginal areas and under conditions of low levels of technological inputs. P.K.R. Nair, ICRAF.

Agro-forestry is a socially, culturally, and ecologically acceptable, integrated form of land use involving trees that improves or does not degrade the soil and permits increased and sustained production of plant and animal produce including wood.- R.B. Contant, ICRAF.

Agro-forestry is a sustainable land management system which increases the overall yield of land, combines the production of crops (including tree crops) and forest plants and/or animals simultaneously or sequentially, on the same unit of /and, and applies management practices that are compatible with the cultural practices of the local population.- K.S.F. King and M.T. Chandler, ICRAF, in The Wasted Lands.

Then again:

Agro-forestry should be considered to be a generic term that embraces the following specific components:

Agri-silviculture- the conscious and deliberate use of land for the concurrent production of agricultural crops (including tree crops) and forest crops.

Silvo-pastoral systems - land management systems in which forests are managed for the production of wood as well as for the rearing of domesticated animals.

Agro-silvopastoral systems in which land is managed for the concurrent production of agricultural and forest crops and for the rearing of domesticated animals. This system is, in effect, a combination of agri-silviculture and the silvopastoral system.

Multi-purpose forest tree production systems here forest tree species are regenerated and managed for their ability to produce not only wood, but leaves and/or fruit suitable for food and/or fodder. - K.F.S. King, ICRAF.

More detailed forms might be:

Agro-forestry is any type of multiple cropping land use that:

> - entails complementary relations between tree and agricultural crops and produces some combination of food, fruits, fodder, fuel, wood mulches, and so forth;
> - is usually, but not necessarily, low input;
> - achieves a more efficient use of radiant energy (sunlight), moisture and plant nutrients than is effected by sole cropping or by separate agricultural or tree production systems, reduces or prevents soil and land deterioration processes such as erosion, leaching, and floods, or the effects of excessive insolation on bare soil.
> - C.F. Bentley, Chairman, International Crops Research Institute for the Semi-Arid Tropics.

or

Agro-forestry is any land use system that:

> - provides fuel as well as tree/shrub products (or the environmental benefits that may accrue from growing

trees/shrubs);
- involves multiple, mixed or zonal cropping, with or without animal production, in which woody perennials are grown for more than one purpose together with herbaceous crops or grasses.

Through these combinations agro-forestry aims to:

- maximize use of radiant energy, minimize losses of plant nutrients in the system, as well as optimize water-use efficiency and minimize run-off and soil loss. Thus it retains any benefits in these respects that may be conferred by woody perennials compared with conventional agricultural crops, and so maximizes total output of benefits from the land whilst conserving and improving it. Peter A. Huxley, ICRAF.

Agro-forestry is a collective name for land use systems in which woody perennials are deliberately grown on the same piece of land as agricultural crops and/or animals, either in some form of spatial arrangement or in sequence. In agro-forestry systems, the woody component interacts ecologically and economically with the crop and/or animal components. Such interactions will take many different forms, both positive and negative, and they need not remain stable over time. The aim and rationale of most agro-forestry systems are to optimize the positive interactions in order to obtain a higher total, a more diversified and/or a more sustainable production from the available resources than is possible with other forms of land use under prevailing ecological, technological and socioeconomic conditions. Bjorn Lundgren, ICRAF.

Appendix 2. Action Guidelines on Education in Agro-forestry

Extracted from full set of guidelines on research, development and education drawn up at the ICRAF/DSE Conference on International Co-operation in AgroforestN, 16-21 July 1979, Nairobi, Kenya.

Recommended that:

1. Institutions of higher education in agriculture and forestry collaborate closely and adopt the following measures:

(a) add courses in farming/land use systems and agro-forestry to their undergraduate and postgraduate curricula;

(b) incorporate agro-forestry-related aspects into all relevant existing courses;
(c) identify agro-forestry-related research opportunities in all relevant postgraduate specialization, where applicable, in cooperation with research institutions.

2. Technical agricultural and forestry schools introduce a general agro-forestry course unit.

3. In-sewice courses in agro-forestry, which are urgently needed for the training of teaching staff at all levels, be of the following kinds:

(a) scientific/technical courses at post-M.Sc. level, for different specializations;
(b) technical courses at (post-) B.Sc. level, similar to the agro-forestry courses advocated for regular undergraduate programmed;
(c) special courses for agrarian reform planner and administrators.

4. Regular agro-forestry courses at undergraduate and technical levels be organized on a national rather than a regional basis. Local institutions should, therefore, be made self-reliant as soon as possible by the provision of relevant packages of teaching material.

5. As postgraduate programmes are costly and highly demanding in terms of manpower and physical resources, a regional approach based on the co-operation of a number of universities be followed.

6. In-service courses at all levels be organized on a regional basis at well-equipped faculties of agriculture and forestry, taking into account linguistic and ecological considerations in the choice of locations.

7. Demonstration plots on agro-forestry be established on each of the different ecological zones for the purpose of training professional and technical staff and for the dissemination of information to the public.

8. A modular approach be adopted in the preparation of agro-forestry teaching materials, with the following priorities:

(a) a general agroforestry module, intended as a basis for technical in-service courses and for graduate and postgraduate course units. This module could gradually be differentiated into packages for different ecological regions;

(b) a module for planners and administrators, to be combined with an abridged version of module (a);
(c) a series of discipline-specific modules, intended as a basis for scientific/technical in-service courses in combination with module (a) and also for incorporation into the regular courses of graduate and postgraduate programmes in agriculture, forestry and related disciplines.

9. Postgraduate research projects in agro-forestry form part of large interdisciplinary programmes conducted and/or guided by teams of scientists.

10. Governments take steps to familiarize primary and secondary school children with the role of multipurpose trees in rural development.

11. ICRAF:

(a) Play a coordinating role in the preparation and continuing improvement of teaching packages consisting of course outlines, lecture notes, lists of reference, additional reading material and audio-visual aids, for inservice courses, agro-forestry course units and agro-forestry related elements in the relevant agricultural and forestry, subjects;
(b) Lend support to those institutions of higher education that wish to initiate an agroforestry option in their undergraduate programme (agriculture or forestry);
(c) Participate actively in the establishment of a network of regional centres for postgraduate training and research as well as in-service courses in agro-forestry using existing institutions of higher agricultural and forestry education;
(d) Compile handbooks on multipurpose tree species potentially useful for agro-forestry systems, containing information on ecological requirements, distribution, possible uses and seed sources;
(e) Coordinate the writing and publication of textbooks on agro-forestry at higher technical and university level;
(f) Prepare, distribute and periodically update a directory of scientists with training and/or experience in agro-forestry;
(g) Request at regular intervals from all agricultural and forestry schools, colleges and faculties, information on

agro-forestry courses and programmes;
(h) Explore the desirability of an agro-forestry journal and, if considered desirable, assume a coordinating and editorial role;
(i) Examine the feasibility of restructuring the undergraduate programme on the basis of a systems approach and incorporating agro-forestry elements, and, if feasible, prepare the curricula and syllabuses for such a programme.

References

Contant, R.B. 1979. "Training and Education in Agro-forestry." In T Chandler and D. Spurgeon, eds., International Co-operation in Agro-forestry. pp. 190-218. Proceedings of an International Conference, DSEIICRAF. Nairobi.

Huxley, P.A. 1976a. Agricultural Re-education." Span, 19: 80.
- 1976b. Addendum to "Agricultural Re-education." in C.L. Keswani et al., eds., Proceedings of Workshop on Agricultural Curricula for Undergraduate Students. pp. 335-345. Faculty of Agriculture, Forestry and Veterinary Science, University of Dar-es-Salaam. Morogoro, Tanzania.
- 1979. "Agro-forestry at Degree Level: A New Programme Structure." In T. Chandler and D. Spurgeon, eds., International Co-operation in Agro-forestry. pp. 219-227. Proceedings of an International Conference; DSEACRAF. Nairobi.

Roche, L., and R. Cooper. 1980. "Forestry for Local Community Development: Manpower, Training and Education Requirements. Commonwealth Forestry Review, 59: 163-179.

Discussion

Education in agro-forestry could be considered at a number of levels - training higher-level staff, and training field workers {especially extension workers) and, through them, the farmers themselves. One of the most important duties of the higher staff would be to train extension workers.

A large and growing number of institutions claimed to be giving courses in agro-forestry, and this was also covered to some extent in courses labelled, for instance, "Applied Ecology." Agro-forestry was a fashionable subject, and there were dangers that some institutions would initiate courses without adequate facilities being available. Maintenance of standards was important.

Strengthening of existing institutions was probably more important than the creation of new ones.

There were difficulties in selection and recruitment of both lecturers and students. Very few people were available with qualifications in agro-forestry, and it would be necessary to begin by employing as lecturers people who had been trained in other disciplines. The important thing was that they should be prepared to co-operate with others within a multidisciplinary framework. As for students, one suggestion was that training might begin at the M.Sc. level, but the view was also expressed that high academic achievement alone was not the best criterion for selection of workers whose duties would be mainly working with farmers in rural areas.

Courses in agro-forestry should be co-ordinated with related subjects such as community forestry and rural energy programmes. As the success of agro-forestry was largely dependent on relationships with people, studies should have a high emphasis on social relationships. The emphasis of Dr. Huxley on field work was generally welcomed, though one participant pointed out that this could be more expensive than classroom work.

Apart from specialists in agro-forestry, all those concerned with land-resource development should have some knowledge of the subject and courses for such people were also an important part of agro-forestry education. Another important function of agroforestry institutions was the provision of library and documentation services.

With regard to extension workers and training of farmers, it was suggested that, rather than attempting to set up a new cadre of agro-forestry extension workers, with the confusion this could cause in the minds of the farmers, existing agriculture or forestry extension workers could be trained in the techniques of agroforestry. Such workers must be in close contact with the farmers, both men and women, and be prepared to accept feedback from them. They should tell the people what was possible, relying on them to say what their needs were.

Extension workers, however, could not be left on their own. Higher officials also should go among the farmers and discuss their problems with them, to ensure that the programme was adhering to the principles and lines of approach laid down.

Pilot or model farmers could play an important part in spreading

knowledge to their neighbours, and many field trials should be made on farmers' own farms demonstration was always more convincing than propaganda.

Provision of training material in agro-forestry could form an important part of adult literacy programmes. There was a general need for such material, which could best, however, be prepared on the spot by the extension services.

The dynamics of the shifting cultivation, rural poor, cattle complex on marginal lands in the humid tropics

John Bishop

Introduction

Much of the land in the wet tropics is marginal for agriculture, either because of steep slopes or of low soil fertility {Table 1). These lands are, however, normally covered with tropical forests which have the highest biomass and dry-matter production of all terrestial ecosystems (Table 2). This apparent contradiction is due to the fact that the nutrient level built up over time is maintained in a cycle between forest and soil (Herrera et al. 1978, Jorgensen et al. 1975).

When tropical forests are felled, the cycle is broken and the nutrient level decreases significantly after only a few years. This process of soil degradation proceeds fastest where temperatures are highest, rainfall greatest and slopes steepest. If forest vegetation is restored before soil structure and nutrient content decline below critical levels, the nutrient level can be rebuilt. The shifting field cultivationlfallow system, which has sustained much of humanity for millennia, is based on this principle and is the dominant farming system on marginal lands in the wet tropics (Buol and Sanchez 1978, Okigbo and Lal 1979).

An estimated 300 million ha of marginal lands in the wet tropics are at present under small farm. shifting field cultivation and produce basic foodcrops (corn. beans, rice, cassava, plantains, yams, sweet potatoes, cocoyam, taro, etc.) and fuelwood for more than 250 million people; figures which could easily double by the year 2000 (Bene et al., 1977). Production of foodcrops and fuelwood, as well as the generation of major cash income, capital and employment, are basic necessities which can only be met to a small extent from small permanent multistorey dooryard gardens (Atmosoedarjo and Wijayakusumah 1979), but require larger land

areas under a shifting field cultivationlfallow system (King 1979), or under permanent agriculture.

Shifting field cultivation is an efficient long-term sustained yield farming system for population densities up to about ten people per square kilometre. The measure of efficiency is based on the use of the most limiting resource: energy. Shifting cultivators expend one calorie of labour energy to produce sixteen calories of food, while United States farmers spend one calorie of fossil fuel to produce only three calories of food (Greenland and Herrera 1977).

Shifting CultivationlRural PoorlCattle Complex

Throughout the wet tropics, however. the practice of shifting field cultivation is changing rapidly due to increased population growth rates and in-migration. The introduction of cash cropping has also resulted in a shortening of traditional fallow periods, and the introduction of grassland cattle production has resulted in a further reduction of land area available for shifting field cultivation (FAO 1978).

TABLE 1. Land Area and Soil Fertility Status of Major Climatic Regions in the Tropics (After Norman 1979)

				Soil Fe
Climate	**Wet[a] Months**	**Vegetation**	**Land Area**	**High[b]**
Wet	7-12	Forest	2,601 (53)[d]	399 (8)
WetlDry	4.5-7	Savannah	1,020 (20)	377 (7)
Dry	0-4.5	Scrub	1,332 (27)	792 (16
			4,953 (100)	1,568 (3

a A month with over 100 mm of rainfall is regarded as wet (precipitation exceeding evapotransporation).
b High base status soils (vertisols, mollisols, aridisols and aridic groups), allovial soils (aquepts, fluvents and others), moderately leached soils (andepts, tropepts, and others).
c Low base status soils (oxisols, ultisols, alfisols). dry sands and shallow soils (psamments and lithic groups).
d Million hectares (percentage).

TABLE 2. Dry Matter Production of Natural Vegetation in Different Climates (After Holliday 1976)

Climate	**Dry Matter Production**

	(tlhalyear)
Wet tropics	146
Wetldry tropics	104
Dry tropics	55
Temperate	50

As human populations and expectations increase, fallow periods are shortened, accelerating at an alarming rate soil deterioration and infestations by weeds, pests and diseases, and critically decreasing basic foodcrop yields precisely as needs are increasing. This decrease in yields as a consequence of the shortening of the fallow period often makes the clearing of more unused forest land more rewarding than continuing the cultivation fallow cycle for more than about two or three cropping cycles on the same site (Bishop 1978, USAID 1978).

In Latin America after the second or third cropping cycle (approximately twenty years), land is frequently converted to grass pasture often to be sold to large cattlemen, and the small farmers migrate to new forest land to repeat the same process. This is done because the old land has passed the point of diminishing returns for basic foodcrop production, but can still be used for large-scale cattle production on grass pasture for another twenty to forty years in an ever more extensive grazing system. The grass' pasture, however, cannot be sustained and runs a "downhill" course due to continuous soil deterioration and multiplication of weeds and pests, and after twenty to forty years is, for all practical purposes, completely degraded (Parson 1976).

Not only is degradation of already "developed" lands reducing existing potentials, but also the limit of the shifting cultivationlcattle frontier is being quickly reached in many areas of the wet tropics. In these areas, the shifting cultivation, rural poor, cattle complex is the major underlying cause of accelerated spontaneous colonization of marginal land, natural resource degradation, human resource impoverishment, and rural to urban migration Bishop 1982, Bishop et. al. 1981).

The spontaneous colonization of marginal lands in the wet tropics, particularly in Latin America, can be divided into three stages, first an extraction phase when small farm colonization and logging begin in earnest, until in-migration ceases. The second stage is an expulsion phase, when free forest land is no longer available, natural resources become extensively depleted and production of

foodcrops and small farm fuelwood shows severe signs of stress. This culminates in an intensive expulsion of small farm families towards remaining frontiers or urban centres. The third and final stage is an exhaustion phase, when income from continuously decreasing cattle stocking rates no longer equal the ever-increasing labour costs for weed control. Today, many of these degraded grass pastures cannot be economically maintained and are being abandoned (Bishop 1979).

It is quite possible that within the next two decades most marginal lands in the wet tropics will be degraded, given the intensity of colonization and the vast scale on which tropical forests are being transformed into extensive "downhill" grass pastures at high social and ecological costs (Myers 1980, Walton 1980). When the colonization of the remaining tropical forests has been completed, most of the rural poor will be no better off economically, only twice as numerous! As the shifting cultivation, rural poor, cattle complex is the process that is degrading so rapidly the marginal land resources throughout the wet tropics, improving mixed small farming systems must be addressed as a priority issue.

Successful long-term sustained yield systems on marginal lands in the wet tropics depend on stabilizing soil structure and erosion, controlling multiplication of weeds, pests and diseases, and maintaining soil nutrients and organic matter at levels suitable for each type of land use. These levels inevitably change from those generally found under natural forests and may display cyclic variations; they cannot, however, be allowed to decline continuously. Solutions to these problems are some of the most difficult challenges facing tropical agriculture today.

Legume ForagelFuelwood Fallows

One promising innovation is to intensify land use under shifting field cultivation with tropical forest sheep on legume foragelfuelwood fallows (Bishop 1980, Bishop 1982).

Forage and fuelwood legumes increase soil aeration, organic matter, nitrogen and available phosphorus, control soil erosion and leaching, as well as provide a break in cropping that checks pest, disease and weed build-ups (Sprague 1976). Tropical forest sheep improve soil fertility by depositing organic matter which stimulates legumelRhizobium symbiosis and by supplying faecal micro-organisms which mineralize crop residues (Bredero 1977). In addition, tropical forest sheep cause little soil compaction and erosion, and produce high quality food protein by grazing legume

cover forage, besides generating cash income, capital and employment for small farmers (McDowell and Hildebrand 1980).

In Amazonian Ecuador, studies are being carried out on the intensification of fallow periods by grazing African tropical forest type sheep (studies began in November 1979) on the Asian tropical forest legume cover forage, Desmodium ovalifolium (studies began in April 1978) under American tropical forest legume fuelwood trees, Inga edulis (studies began in February 1976).

Desmodium ovalifolium is a commercial Asian legume cover crop used under rubber and oil palm, as well as a promising legume forage in the American wet tropics (Bishop 1980a; CIAT 1981). Desmodium ovalifolium is a vigorous, very stoloniferous, non-climbing, perennial cover which cascades over banks and steep slopes effectively binding soil and controlling erosion. In addition, due to its heavy seed-producing ability, vigorous stoloniferous growth, medium palatability, and extreme tolerance to shade and low fertility soils, it is one of the most persistent legume forages under forest grazing in the wet tropics.

The nutrient cycling function of a fallow depends very much on the density and extent of its root system. The present fallow system combines the dense, shallow-rooted legume cover forage Desmodium ovalifolium with the deep-rooted legume fuelwood tree Inga edulis. A deep rooting system has the double function of bringing up nutrient ions released at depth and of trapping downward-moving ions when an excess of water leads to leaching (Akin 1979).

The protective function of the fallow depends very much on providing effective and continuous soil cover. Inga edulis trees coppice well, protect the soil from the full force of high intensity tropical rains, and provide shade to smother crop weeds as well as to lower soil temperatures which in turn reduces soil organic matter mineralization rates (Ahn 1979).

Inga edulis is a very fast growing legume fuelwood species. Its trunk diameter grows in excess of 5 cm per year and provides excellent fuelwood and charcoal in less than six years. Inga edulis is commonly used throughout the American tropics for its fuelwood and as a shade tree for coffee and cocoa. Also its seeds are enclosed in a sugary, edible pulp and its flowers are rich in nectar and attract bees (Anon. 1980).

Desmodium ovalifolium and Inga edulis are both easily

established from their abundant seeds (without inoculum or scarification) and are interplanted following weeding during the food cropping period (Fig. 1). Desmodium ovalifolium is established at a rate of 4-5 kglha with a pinch of seed sown every metre and Inga edulisseeds are planted every 8 metres.

Tropical Forest Sheep Among the world's ruminants, sheep are second only to cattle in their production of highquality food protein (Winrock 1977). The majority of the world's 1 billion sheep have wool and are in the temperate zone. However, an estimated 100 million "hair sheep" (Winrock 1979) are kept in the lowland tropics of Africa, America and Asia (Tables 3-5). Although thought to have originated in Asia, hair sheep were widely distributed throughout tropical Africa by early Christian times (Grigg 1974).

TABLE 3. Number of Tropical Hair Sheep in Selected Countries of the American Tropics (Mason 1980, Winrock 1979)

Country	Number
Brazil	6,000,000
Columbia	
Venezuela	798,000
Guyana	
Cuba	
Mexico	
Dominican Republic	455,400
Barbados	
Total	7,253,400

TABLE 4. Number and Distribution of Tropical Sheep in Indonesia[a] (Mason 1980)

Location	Number
West Java (wetter end)	1,450,000
Central Java	928,000
East Java	475,000
Other islands	354,000
Total	3,207,000

a 96 per cent of sheep in South-East Asia are in Indonesia.

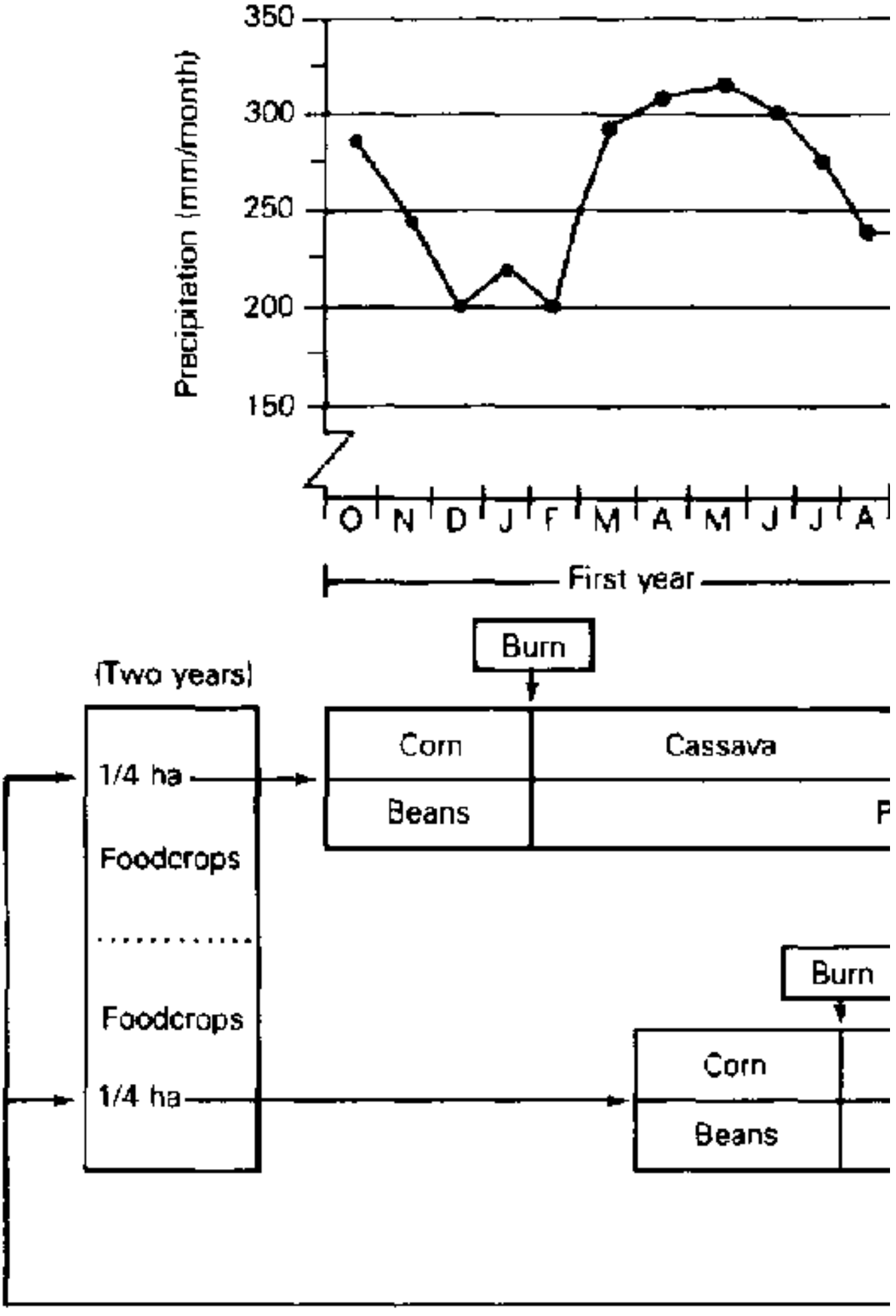

FIG. 1. Average monthly precipitation in the Ecuadorian Amazon and cropping sequence in an eight-year field rotation system

(starting a new half ha field each year)

TABLE 5. Number of Tropical Hair Sheep and Cattle in Selected Countries of West Africa

Country	Hair Sheep	Cattle
Nigeria	18,099,000	8,235,000
Ivory Coast	722,000	516,000
Ghana	902,000	777,000
Togo	792,000	214,000
Benin	881,000	726,000
Total	21,396,000	10,468,000

Epstein (1971) identifies two general types of thin-tailed hair sheep in Africa: the West African "forest type" and the Sahelian "savannah type". The African forest type sheep were introduced into the American tropics on slave ships in the seventeenth century (Bradford and Fitzhugh 1981, Mason 1980). Tropical forest type sheep are hardy and well adapted to hot humid climates, being uniquely tolerant of trypanosomiasis, haemonchosis, and foot rot (Hill 1980).

Another important characteristic of tropical-forest sheep is that they cause little soil compaction and erosion on marginal lands of the wet tropics. One of the consequences of continuous cattle grazing, coupled with high-intensity tropical rains, is the progressive deterioration of soil structure, resulting in crusting, low infiltration rates, and accelerated soil erosion even on gentle slopes. Cattle are also less agile than tropical forest sheep and only climb steeper slopes when driven by hunger. Cattle, therefore, overgraze pastures with gentle to moderate slopes and the steeper hillsides become corrugated or honeycombed by closely spaced cattle paths. These zigzag cattle trails lack vegetative cover and become unstable and subject to sliding, and also collect runoff water, causing accelerated erosion and gullies (Bishop et al. 1981, Bishop 1982).

In the studies in Amazonian Ecuador referred to above, the breed of sheep used is Red Afro-Colombian X Barbados Black Belly. Tropical forest sheep accept less palatable forages, such as Desmodium ovalifolium to a greater extent than cattle. The small size, early maturation, high fecundity and resulting high offtake of tropical forest sheep also fit well the grazing needs in small farming

systems in the wet tropics. The Upper Amazon countries of Ecuador, Peru and Bolivia have large sheep populations which are mainly found on small farms (Tables 6-7).

Red Afro-Colombian hair sheep were introduced into the Ecuadorian Amazon beginning in late 1979. By mid-1980, the flock numbered twenty purchased ewes and one purchased ram. In early 1981, two Barbados Black Belly rams were imported and by mid-1982 the flock had increased by natural multiplication to over 100 head. Young ewes lambed for the first time between the ages of 11 and 13 months, with a lambing interval of between 6 and 8 months and a lambing rate of 1.35 to 1.80 lambs per litter. The larger the litter size, the longer the lambing interval. Male lambs reach market weights of 40-45 kg in 11 to 13 months. The sheep are adapted to the ever wet climate and foot rot has not been observed.

TABLE 6. Number of Sheep and Cattle in the Upper Amazon Countries of Ecuador, Peru, and Bolivia (Delury 1978)

Country	Sheep	Cattle
Ecuador	2,150,000	3,300,000
Peru	14.000.000	4,300.000
Bolivia	7,508,000	2,326,000
Total	23,658,000	9,926,000

TABLE 7. Percentage of Farms and Sheep by Farm Size in Ecuador (Arias, 1978)

Farms Farm size	Sheep (percentage)	(percentage)
0-20	87.7	84.9
20-50	7.8	4.8
> 50	4.5	10.3

Short lambing intervals (every six months), multiple births (1.35 lambslewe), early maturation (twelve months), and year-round breeding help to make tropical forest sheep three times more productive than cattle grazing perennial forages in the wet tropics. A comparison is made in Table 8.

In addition, the conversion of solar energy into plant dry matter in the wet tropics can be three times as great as that of temperate

and dry tropical regions (Table 2). In the wet tropics, where there is a continuous thermal and hydrological growing season, perennial forages are photosynthetically fully active throughout the year and yields reflect actually realized performances. In temperate and dry tropical zones, maximum yields of pasture are 20 to 25 tlhalyr, as against 60-80 tlhalyr in the wet tropics (Cooper 1970).

Tropical forest sheep in the wet tropics should, therefore, be capable of producing an offtake (kglhalyr) considerably higher than that of cattle grazing perennial forages in temperate or dry tropical regions.

Transfer of Improved Technology

Current efforts to transfer technology to small farmers mainly employ the demonstration technique on more progressive farms. While this technique is relatively easy to execute, the few farmers that benefit are those with better incomes. The resulting effect tends to widen the gap between the rich and the poor, as technology does not easily "trickle down" to poorly educated marginal small farmers.

The mass training of small farmers is essential for improved management of marginal lands in the wet tropics and is one of the most difficult challenges facing national institutions. In Amazonian Ecuador, human resource development for improved land resource development is aided by the provision of effective educational materials for mass small-farmer training programmes. Small-farmer training materials are being prepared on "Multistorey Dooryard Gardens with Backyard Poultry and Swine" and "Fieldcrops in Rotation with Tropical Sheep on Legume ForagelFuelwood Fallows. "

TABLE 8. Comparison between Tropical Sheep and Tropical Cattle

	Tropical Sheep	**Tropical Cattle**
Parturition ratelinterval	1.35 lambs/6 months	1.0 calf/12-14 mo
Number of offspring/year	2.7 lambs/year	0.9 calves/year
Age at market or first parturition	12 months	36 months

The small farmer training materials aid ongoing integrated rural development projects through local adult education centres, radio education courses and practical classes in rural schools. The effects

of the training materials are:
(a) transfer of improved technology;
(b) motivation of the small farm population towards agricultural vocations and thus reduce rural/urban migration; and
(c) enhancement of adult literacy programmes by provision of practical auxiliary reading materials.

References

Ahn, P.M 1979. "The Optimum Length of Planned Fallows." In H.O. Mongi and P.A. Huxley, eds., Soils Research in Agro-forestry. Nairobi. pp. 15-39.

Anon. 1980. Firewood Crops: Shrub and Tree Species for Energy Production. National Academy of Sciences, Washington D.C., p. 237.

Arias, E. 1978. "DiagnÃ³stico Socio-econÃ³mico del Medio Rural Ecuatoriano." Documento No. 5 Ganaderia. Programa Nacional de RegionalizacÃ on Agraria, Ministerio de Agricultura y Ganaderia, Quito, p. 249.

Atmosoedarjo, S., and K Wijayakusumah. 1979. "Ecological Aspects of Agro-forestry in the Lowland Humid Tropics: Southeast Asia." In T. Chandler and D Spurgeon, eds., International Cooperation in Agro-forestry. Proceedings of an International Conference, DSE/ICRAF, Nairobi, pp. 117-128.

Bene, J.G., H.W. Beall and A. Cote. 1977. Trees, Food and People. International Development Research Center, Ottawa. 52 pp.

Bishop, J.P. 1978. "The Development of a Sustained Yield Tropical Agro-Ecosystem in the Upper Amazon." Agro-Ecosystem, 4: 459 461.
- 1979. "Produccidn Ganadero-Forestal en el TrÃ³pico Humedo Hispanoamericano." In XIII Annual Conference on Livestock and Poultry in Latin Amenca, sponsored by the University of Florida, Gainesville. 6 pp.
- 1980a. "Agro-Forestry Systems for the Humid Tropics East of the Andes." In International Conference on Amazonian Agricultural and Land Use Development, Sponsored by ICRAFICIAT/RF/GTZ/NCSU, Cali, Colombia. 23 pp.
- 1980b. "Mixed Foodcrop/Small Stock/Firewood Production for Small Farms in the Humid Tropics East of the Andes." In lnternational Conference on the Rationalization of Agacultural Natural Resources on Small Farms, sponsored by Food and

Agriculture Organization, Kingston, Jamaica. 19 pp.
- 1982. Tropical Forest Sheep on Legume Forage fuelwood Fallows. Agro-forestry Systems. 19 pp.

Bishop, J.P., R. Hudgens, and D Gow. 1981. "Dynamics of Shifting Cultivation. Rural Poor, Cattle Complex in a Humid Tropical Forest Life Zone." Research Note No. 2 (manuscript). Development Aiternatives Inc., 1823 Jefferson Place, N.W. Washington, D.C. 23 pp.

Bradford, G.E. and H.A.. Fitzhugh 1981. Hair Sheep: Genetic Resource for Tropical Agriculture. Winrock International Livestock and Training Center, Morrilton, Arkansas.

Bredero, T.J. 1977. "The Role of Farmyard Manures and Green Manures in Soil Fertility Restoration in the Humid Tropics." Abstr Trop. Agric., 3: 9-17.

Buol, S.W. and P.A. Sanchez. 1978. "Rainy Tropical Climates: Physical Potential, Present and Improved Farming Systems." Plenary Session Papers of the 11th International Congress of SoilScience. Edmonton, Canada. Vol. 2: 292-312.

CIAT. 1981. Informe CIA T. Centro Internacionai de Agricultura Tropical. Cali, Colombia, 124 pp.

Cooper, J.P. 1970. "Potential Production and Energy Conversion in Temperate and Tropical Grasses." Herb. Abst. 40: 1-15.

Delury, G.E. 1978. The World Almanac and Book of Facts. Newspaper Entreprise Assoc., Inc., New York. 976 pp.

Epstein, H. 1971. The Origin of the Domestic Animals of Africa. Vol. II. Africana Publ. Co., New York.

FAO. 1978. Forestry for Local Community Development. FAO Forestry Paper No. 7, Rome. 114 pp.

Goodland, R. 1980. "Environmental Ranking of Amazonian Development Projects in Brazil." Environmental Conservation, 7: 9-26.

Greenland, D.J. and R. Herrera, 1977. "Shifting Cultivation and other Agriculture Practices." In Patterns of Use of Tropical Forest Ecosystems (manuscript). Soil Science Department, University of Reading, United Kingdom.

Grigg, D.B. 1974. The Agricultural Systems of the World: An Evolutionary Approach. Cambridge Geographical Studies No 5. Cambridge University Press, Cambridge. 358 pp.

Herrera, R., C.F. Jordan, H. Klinge, and E. Medine. 1978. "Amazon Ecosystems. Their Structure and Functioning with Particular Emphasis on Nutrients." Interciencia, 3: 223-230.

Hill, D.H. 1980. Production of Small Ruminants in the Humid Zones. International Livestock Center for Africa (ILCA), Addis Ababa. 23 pp.

Holliday, R.H. 1976. "The Efficiency of Solar Energy Conversion by the Whole Crop." In A.N. Duckham, J.G.W. Jones and E.H. Roberts, eds., Food Production and Consumption. NorthHolland Publishing Company. Amsterdam and Oxford. pp. 127146.

Jorgensen, J.R., C.G., Wells, and L.J. Metz. 1975. "The Nutrient Cycle: Key to Continuous Forest Production." J. Forestry, 73: 400-403.

King, K.F.S. 1979. "Concepts of Agro-forestry." In T. Chandler and D. Spurgeon. eds., Intemational Cooperation in Agroforestry. Proceedings of an International Conference. DSE/ICRAF, Nairobi pp. 1-13.

Mason, l.L. 1980. Prolific Tropical Sheep. Food and Agriculture Organization, Rome. 124 pp.

McDowell, R.E. and P.E. Hildebrand. 1980. Integrated Crop and Animal Production: Making the Most of Resources Available to Small Farms in Developing Countnes Working Papers, Rockefeller Foundation, New York. 78 pp.

Myers, N.1980. Conversion of Tropical Moist Forests. Report for the Committee on Research Priorities in Tropical Biology, National Research Council. National Academy of Sciences. Washington, D.C. 204 pp.

Norman, M.J.T. 1979. Annual Cropping Systems in the Tropics. University of Florida Book, University Presses of Florida, Gainesville. 276 pp.

Nye, P.H. and D.J. Greenland,. 1960. The Soil Under Shifting Cultivation. Commonwealth Bur Soils, tech. Commun, 51, Harpenden, United Kingdom. 156 pp.

Okigbo, B.N. and R. Lal. 1979. "Soil Fertility Maintenance and Conservation for Improved Agro-forestry Systems in the Lowland Humid Tropics." In H.O. Mongi and P A. Huxley, eds., Soil Research in Agro-forestry. Nairobi. pp. 41-77.

Parson, J.J. 1976. "Forest to Pasture: Development or Destruction?" Rev. Bio. Trop, 24 (Suppl. 1): 121-138.

Spears, J.S. 1979. "Can the Wet Tropical Forest Survive?" Commonwealth Forestry Review, 58: 165 80.

Sprague, H.B. 1976. "Combined Crop/Livestock Farming Systems for Developing Countries of the Tropics and SubTropics." Technical Series Bulletin, No. 19, Office of Agriculture, Technical Assistance Bureau, Agency for International Development, Washington, D.C. 30 pp.

USAID, 1978. Proceedings of the U.S. Strategy Conference on Tropical Deforestation. Sponsored by U.S. Agency for International Development, Washington, D.C. 78 pp.

Walton, S. 1980. "Replacing Trees with Wasteland: The Demise of Tropical Moist Forests." BioScience. 30: 377-81.

Winrock, 1977. The Role of Sheep and Goats in Agricultural Development Winrock International Livestock Research and Training Center. Morrilton, Arkansas. 223 pp.
- 1979. Hair Sheep Production Systems. Winrock International Livestock Research and Training Center, Morrilton, Arkansas. 117 pp.

Considerations of social, economic, institutional, and legal aspects of agro-forestry in Venezuela

Eduardo E. Escalante

This paper will give a broad outline of what has been done in agro-forestry in Venezuela up to the present time, as well as considering the social, economic, institutional, and legal aspects of this system there.

Venezuela is located in the northern part of South America, between approximately 2Â° and 10Â° N. Its area is 912,000 kmÂ² At the beginning of the 1970s it was estimated that of this area, 350,000 kmÂ² consisted of primary tropical rain forest of which 89 per cent was located south of the Orinoco River.

It is estimated that 74,000 kmÂ² of land north of the Orinoco River was originally covered by tropical rain forest, but at the present time only 30 per cent of this remains intact, the other 70 per cent having been deforested for the establishment of agricultural crops and grazing for livestock (33 per cent disappeared in only twenty-five years, between 1950 and 1975).

The other two biomes where agricultural activities take place are the savannahs and the deciduous forest; both of these are considered to be tropical dry forest, in which monoculture and extensive livestock grazing take place. They cover an area of approximately 250,000 kmÂ², mainly north of the Orinoco River.

Most other biomes are affected by slash and burn agriculture for the establishment of conucos as a result of the high pressure on land in rural areas. It can thus be seen that the development of land for agriculture is based on the destruction of the natural ecosystem, mainly in the tropical dry and rain forest.

In the last few years, the Ministry of Natural Resources has permitted the deforestation of 175,000 hectares per year but in practice this is only about a half of the area actually cleared, as most small farmers (campesinos) are not greatly concerned about obtaining legal permission from the ministry. In 1977, photo-interpretation using satellite images showed that 660,000 hectares of forest had been totally destroyed north of the Orinoco River. It is important to point out that less than 10 per cent of the deforested area is reforested annually.

Another aspect is the drain on the forest from firewood used by the campesinos for cooking. In 1976 it was estimated that 36,000 tonnes of firewood and 11,000 tonnes of charcoal were produced.

Agro-forestry is an old practice in Central and South America. The tropical forest is characterized by a high diversity of species and a multilayered structure, and it is thought that it was from this model that the indigenous cultures took their agricultural model of the conuco, establishing crop areas with a mixture of many species, annuals and perennials. Thus they mixed corn, cassava, beans, papaya, avocado and other tropical fruit species on the same place, and practiced a type of agro-forestry permitting them to obtain their daily necessities in food and wood.

This model was developed empirically. and without a scientific basis, to meet daily needs within the limitations of the natural environment.

In Venezuela, during the eighteenth and nineteenth centuries, large-scale cocoa and coffee plantations were established. These are crops which need shade for better growth and production, so the traditional practice was to make light clearings in the natural forest leaving the big trees (20-30 metres high) as shade. Later some other tree species were introduced which gave better results. These included Bucare (Erythrina spp) and Guamo (Inga spp) as well as some fruit species: Aguacate (Persea americana) and some citrus trees (Citrus spp). The product of these fruit trees was a useful supplement to the farmers' income. Nowadays some forest species such as Cedro (Cedrela spp.), Pardillo (Cordia alliodora) and Mata de Raton (Glincidia septum) are frequently found as shade trees.

Renewed interest and the possibilities of introducing new techniques to improve the system make agroforestry a valid alternative in helping small farmers to improve their social and economical conditions, in motivating them to continue working the land and in stopping migration to urban areas, which is one of the worst problems faced by agriculture. The rural population has declined during the last seventy years from 60 per cent to 25 per cent of the total population, creating social chaos through the disintegration of the family life of the campesinos and leaving the land with insufficient hand labour. As a consequence. Venezuela now has to import 40 per cent of its annual food requirements.

A good example of the economical value of agro-forestry is in the crop associations located in the central region of the country, mainly in the state of Aragua around Lake Valencia, where the farmers usually grow crops between fruit plantations of avocado and mango, making an efficient use of space, time and radiant energy and also permitting a greater diversification of crop production during the year.

In this area there is a very strong production of fruit and vegetables, sometimes mixed, such as tomatoes, cantaloupes, onions, carrots, sugar beet, papaya and eggplants growing among the avocado (Persea americana), mango (Mangifera indica) and orange (Citrus spp.) trees.

In the upper valleys of the state of Carabobo and Yaracuy, citrus production is very high and the same systems are used. Here is also found one of the best examples of agroforestry, consisting of the use of stakes of Mata de Raton (Gliricida septum) as a support for plants of the passion fruit Parchita (Passiflora edulis), as this species needs to be able to climb upon a wire framework.

A preliminary study found that 300 stakes each about 2.5 metres high are needed to plant one hectare of passion fruit. If metal supports are used the cost per hectare will be approximately $1,400. By using stakes of Gliricidia septum the cost is reduced to $300 per hectare.

In the same system small stakes are used to guide the plants towards the wire; these are also made of Gliricidia septum.

Another crop that also needs small supports to prevent lodging is tomato. In the area mentioned above Mata de Raton stakes are used to build the empalado (a kind of fence to which the tomato plant is tied).

In open parts of the country trees can be seen in grazing fields. This is very important not only from the economical point of view, but also in providing shade and food for cattle.

Examples of the trees used in this kind of "silvopastoral" combination are Saman (Pithecellobium saman) which is commonly used for its shade for the animals and its highly nutritious fruit; and Guacimo (Guazuma ulmifolia) another species widely used in pastures because of the palability of the fruit and its high consumption by animals. Mata de Raton (Gliricidia septum) is very useful not only for shade but also for its value as forage. Studies have shown that its leaves contain a high percentage of protein. It should also be pointed out that this tree is by far the most widely used species for live fence posts in Venezuela.

Of economic timber trees the three species most frequently found associated with pastures are Apamate (Tababuia pentaphylla). Cedro (Cedrela odorata) and Pardillo (Cordia alliodora).

A study at present being carried out by the author in the Cerro 81anco farm in the lowlands of the state of Trujillo (south of Lake Maracaibo) has given the following preliminary results. A random sample of 45 trees from a total of 890 felled had an average height of 22.6 m with a clean bole of 10.2 m, representing 45 per cent of the total height. The average volume of timber was 0.78 m3 per tree giving a total volume of 695 m3 for the 890 trees. As the price per cubic metre is $163 this gives a total value of approximately $113,000 or $127 per tree at the farm. At the sawmill the market price would be $465 per m3.

From the legal aspect. two of the main limitations in forestry

systems in Venezuela are related to forest reserves and land tenure. With respect to the forest reserves, they occupy a very large area of thousands of square kilometres, which cannot legally be used for agriculture or livestock grazing because of restrictions imposed by the Forest Law. Nevertheless, some of the reserves, such as the Ticoporo Reserve, have been settled by campesinos. These add a new problem, as any project directed towards the establishment of an agroforestry system needs to be consulted with them and their acceptance obtained. Similar problems exist with land tenure. Many small farmers are afraid of planting forest trees as they are merely occupants, and not owners of the land. If they plant trees, many of them will no longer occupy the site when the timber is harvested, or else they believe the harvest will be for the benefit of the landowner, and not for them.

In the forest reserve of Ticoporo, Empressa Mixta Forestal Compahia AnÃ³nima (EMIFOCA) and Compahia Nacional de Reforestacion (CONARE), with the advice of FAO, have proposed a project for the best use of the reserve. It includes some agro-forestry alternatives, but these are dependent on permission from the Ministry of Naturai Resources for their instrumentation.

A model has been proposed by CONARE in which. where the relationship of owner and occupant exists, profits from timber sales can be divided between the owner, the reforesting company (CONARE) and the occupant. with a different percentage for each of them.

Institutions like CONARE, Fonda Nacional de Investigaciones Agrapecuaria (FONAIAP), Ministerio del Ambiente y de los Recursons Naturales Renovables (MARNR), Universidad de Los Andes (ULA) and Electrificacion del Caroni (EDELCA) have shown interest in agro-forestry. At first some projects were initiated through the effort and interest of individuals, but in the last two years many of these agencies have included agroforestry projects in their annual plans.

In 1977, the Centro Nacional de Investigaciones Agropecuaria (CENIAP) and FONAIAP began some agroforestry studies in the zone of Barlovento in the state of Miranda; in this experiment, the relationships were examined between some annual and perennial crops. In 1981 CONARE held a meeting on Agro-forestry at Agua Santa, Trujillo, with the advice of ICRAF and FAO. In November of the same year the first seminar on applications of agro-forestry was held in Venezuela, organized by MARNR, CONARE, ULA, EMIFOCA and EDELCA. Several models were presented, and in addition a

methodology proposed by ICRAF was discussed, which included as a first step the investigation of the study area so that appropriate agro-forestry alternatives for its development could be formulated.

Of special interest are two models developed by CONARE for the areas of Casadero in the state of Tachira, and Carache-Burbusay in the state of Trujillo. Both areas are highly eroded and at the present are under a reforestation programme with many forest species, mainly conifers and eucalypts. The idea is to establish pineapple and pastures between the trees; animals, such as sheep and goats, will later be introduced to graze the pastures.

Little attention has so far been given to academic studies of agro-forestry in venezuela, and so far there is no institution devoted to studies of the subject. University courses include some lectures and seminars on the subject. In the Agrarian Department of the Nucleo Universitario "Rafael Rangel" (NURR) at the University of Los Andes two students are working on this topic in theses for their degrees, under the advice of the author.

Continue

Observations on indigenous and modern agro-forestry activities in west Africa

Marilyn W. Hoskins

Agro-forestry is a new term, but the practice of resource management which includes trees and crops is certainly not new to farmers in West Africa. Despite pressures by agricultural extension agents and foresters towards monoculture production, many subsistence farmers have persisted in agro-forestry practices, modifying them in relation to changing resources and demands.

Conflicts which had arisen between the indigenous agroforestry system and modern forestry and agriculture activities were clearly discussed by women of Upper Volta during a 1978 conference held by the SociÃ©tÃ© Africaine d'Etudes et de Developpement, dealing with the impact of development on women. A highly emotional discussion arose during which these women expressed anger at both plantations and farming production schemes.

An example of forestry projects that they gave was a plantation near the capital. Local government officials and forestry advisers

selected a tract of land described by the project directors as "useless bushland." They designed to plan to clear off the brush, scrub and gnarled trees, and to plant fine straight rows of fast-growing exotic fuelwood species. However, neither the project designers nor the foresters had realized that this useless-looking brushland fallow was actually a part of a delicately balanced indigenous agro-forestry system.

Local women helped their husbands in the grain fields and they raised gardens. But beyond these more visible activities, they collected shea nuts (Butyrospermum paradoxum) from which they made cooking oil, they gathered leaves and seeds essential for the nutritional sauces they put over their starchy staple grains, they searched for grasses and bark for weaving and dyeing mats and elaborate baskets, concocted home remedies from leaves, pods and roots, and let their goats browse on the shrubs and bushes in this unused looking area. Women also piled their heads high with dead branches and sticks to carry home for cooking fuel. Their children ate the nutritious monkey bread or baobab (Adansonia digitata) fruit or hunted small animals in the undergrowth. Their husbands cut chew sticks (the local substitute for toothbrushes) and stripped and twisted bark into ropes. The whole family picked and ate "desert raisins" (Ziziphus mauritiaca Lam) and other fruits and nuts, and various family members earned small sums selling firewood or other surplus items which the bushland provided. The land was not - as it had seemed - useless: its use was essential to fulfilling subsistence needs of local populations. With the coming of the project the land was cleared of the natural growth, and what had been everyone's land was planted for fuel for the urban market, becoming off-limits to local residents. This project plantation later was burnt and residents believed the fire started because local traditional land-use rights were overridden by leaders and project managers. Residents had lost access to needed forest products essential in their indigenous agro-forestry system.

An example of the type of agricultural projects which conflicted with indigenous subsistence agro-forestry activities was a resettlement irrigated rice scheme in the Valley de Kou, Upper Volta. Project managers made rice plots available to families on the basis of the number of active family members (adults or older youth) who were all expected to work in the project fields. There was no other land for women's gardens or nearby forest or bushland made available to family members. Although the project reported higher than average incomes, social workers and teachers clearly demonstrated that the standard of living and the nutritional status of family members were much lower.

In Mali, a forestry officer designed a soil and water conservation project near Bamako in which he planned to make berms and plant rows of trees on a hillside which was used for gardening. It was to be a demonstration project which he hoped would show modern techniques of conservation to local farmers. He had not even noticed that although women were gardening on the hillside, that they had left some selected trees standing, and had planted some fruit tree species (mainly mango) along rock walls they had built for soil and water retention. The proposed activity would have cut through the walls and gardens, and would have ruined, not enhanced, these local agro-forestry and conservation efforts. In Guinea, project designers were planning a high-risk project to introduce fodder trees into pastures on land which was burnt yearly. Designers almost failed to note that men and women residents had independently started planting some fodder trees in fence rows around their homes and gardens. A new project could easily begin by simply supporting local efforts if before designing new activities the "specialists," both the farmers as well as the technically trained scientists, would share their information.

Shifting cultivators in Sierra Leone cut trees in field clearing operations at various heights from the ground, to favour regrowth of selected species when the fields are again fallow. Men in a grain-producing rural village near Bo, Sierra Leone, listed eight, and women listed thirty-one products which they they harvested or produced from bushes and trees near their village. They distinguish between items they harvest from growth in fallow land and those which came from the high forests. They speak of the need to preserve trees on hillsides and along waterways. They also practice planting certain crops such as pineapples, peppers, coffee and cocoa under shade trees, and they distinguish certain natural species of trees which offer the best type of shade and those which offer secondary products as well as shade. Though they are farmers, the forests are an essential aspect of their "resource management." The land used one or two years for grain produces forest products until it is again needed for grain.

Throughout Senegal, Upper Volta, Niger, Chad and other areas of West Africa where Acacia albida grows, farmers selectively preserve it in their fields because they value its beneficial effects on surrounding crops, as well as the protein-rich pods they use for fodder. Many other trees, such as Shea (Butyrospermum paradoxum), NÃ©rÃ© (Parkia) and Baobab (Adansonia digitata) - which offer oil-rich nuts, leaves essential to traditional dishes, fruit and/or other important products- are left in the fields despite the fact that they take up space in the crop land. One tree, Moringa

oleifera, is sometimes found planted around the edges of gardens, because its leaves are considered choice ingredients for stews. Studies by Okafor, Reeser, Weber and Hoskins, and Smale among others, clearly demonstrate that a large part of the subsistence needs of West African farming and herding families is provided by secondary and tertiary tree products from trees growing in fields, fallow or pasture lands.

These products are so essential that their potential loss, with the accompanying risk if a monoculture fails, form the major reasons why extension agents have found such resistance to the introduction of "modern" agriculture and forestry.

Even agro-forestry techniques, which sound good on paper, must be applied with an understanding of the specific locale. For example, one type of forestry project, which by its very nature is designed to incorporate both agriculture and forestry, is the taungya system. This approach, which involves planting crops between trees during the first few years of tree plantations, has met with uneven success in West Africa. Successes and failures are, however, understandable when viewed from the perspective of the farm family. When plantations are far from the farm plots, when required labour falls due at the same time as farmers are needed in their own plots, or when participants identify other labour investment as more advantageous, taungya projects may be abandoned or sabotaged. Trees may be killed because residents find the planted species undesirable, because they do not wish to be required to participate further, because they identified tree planting as a prerequisite to land ownership and viewed the project as an effort of the forestry service to take their land, or because they valued the land for crops and knew that when the trees were older they could no longer farm the area. Most of these problems could have been predicted had project designers worked more collaboratively with potential participants during the project identification, the land and species selection, and in the design of the activities.

In other cases where people were land hungry this taungya system opened up desired new areas (often on a shifting basis so that more land was available as the trees grew in successive plots). It is often very popular with the landless who find this the only access to land in some projects. Where farmers have identified the trees as benefiting themselves, they have gladly planted crops during the first few years before the trees were economically productive. However, in some cases, even with local demand, foresters have resisted taungya planting in fear that farmers would damage trees

or try to claim classified forestry land, or because forestry regulations categorically forbid crops being planted on plantations.

As trained foresters and agriculturalists consider approaches to combining their skills and introducing "modern agro-forestry," West African farmers will be deciding whether these new practices will reduce risks, allow them to manage their resources more effectively, or offer other special advantages above their traditional practices. They will judge new ideas in light of the advantages of their present systems and the growing pressure on their resources from population increases, demographic changes, increased technology, and rising expectations. Local men and women farmers are keenly aware that their systems need to change. They speak of shortening fallow, more dust in the air, soil becoming "tired" or "sick," and pressure to cut trees even on hills and along waterways. They are asking for help in managing their resources more effectively.

Wherever technical specialists can identify currently perceived local constraints and pressures they will find an audience ready to hear their ideas. Where project planners can take into consideration strengths and rewards from existing systems and build upon them, they will find their task much easier. On the contrary, where economic or political changes result in a total package less desirable than the current system, little positive response will be found. The challenge for the new agro-forestry agents is to identify potential conflicts between the new and traditional methods of resource management, to analyse when these systems may reinforce each other and when one or the other may offer specific advantages to local residents in their total physical and social environments. Beyond technical issues, socio-economic values, institutional needs, legal regulations and educational requirements will need to be examined.

Socio-economic Values

When project planners fail to study local labour demands or division of activities by sex, age or class, they may plan activities when a certain group or when all available labour is already overburdened. Indigenous agro-forestry practices allow for these constraints.

Local taboos on certain species, activities or the use of certain tools or land are seldom considered by project planners. Some of these beliefs are deeply rooted; others are not. Some are based on historical observation and on understanding of the local

ecosystem and are technologically sound. Whatever the basis of local beliefs, they can have a great impact on project success. In projects where local people are directly involved in species selection, location and activity design, the probability of avoiding problems arising from these types of issues is greatly enhanced.

Priorities of various people and groups involved in agroforestry activities may be vastly different. Programmers may want to increase foreign exchange or raise regional cash crop or fuelwood outputs. Local residents on the other hand may want to spread economic risks and produce food and other products. Economic profit may be only one of a complex of values. In general, traditional practices have been far more successful in spreading risk for the individual and the group. While modern plans may focus on potentially larger production, often for a limited number of the more wealthy farmers, traditional systems have allowed for more economic protection for all local groups, something urgent in areas such as the Sahel. This fact alone should encourage caution in altering the traditional system until the benefits of that system and the new system are carefully considered.

Project planners cannot know all the local socio-economic values of each project area. It follows that local experts on these issues, namely male and female residents, need to be involved in project identification.

Some projects have found great socio-economic success in West Africa. For example, a six-year-old CARE windbreak project in Niger has been found to use 10 per cent of the cropland for trees but to increase crop production by at least 30 per cent. Neighbouring farmers have seen the results and are eager to extend the project to their field.

Institutional Needs

Modern programmes are usually based on much more elaborate institutional support than were the traditional practices. Modern programmes frequently fail when donors are late in producing promised goods or personnel, or when local agencies are unable to provide the required services. There are numerous examples of villagers preparing land for seeds or seedlings which arrive late, half-dead, or never at all.

Residents whose former approach allowed for quite predictable support from neighbours, leaders and merchants find reliance on outside agencies often disappointing. More careful consideration

should be given to identifying institutions that can relate to local residents and can organize the appropriate follow-through. In general, smaller projects with committed agents living in the area, such as was the case in the successful integrated project in Lagbar, Senegal, appear more successful.

Another institutional problem presented by current practices is the unrealistic time period of project cycles which allow support for two or three years even though the activities involved are well recognized to be long-term ventures.

Legal Issues

Legal Issues currently arise over conflict between traditional and modern land-use or usufruct rights. It must be recognized that modern regulations do not come into a vacuum. Herder and farmer groups have complex regulations not only for land use but for access to water and to products coming from the vegetation. In some areas dead wood is a common good; in neighbouring communities it is not. Fruits from specific trees may belong to certain classes of families. Planting of trees may change land ownership and thereby tenants are not allowed to plant on land they have used even for generations.

Modern land-use planning programmes tend to legally privatize land ownership, placing priority on intensive landuse. Indigenous sustained-use of natural vegetation by forest-dwelling, farming, landless, or herding peoples is seldom incorporated into the land title programme. Titles are made available to male heads of farming households for farming land only. Among others, the large number of women farmers who also head households no longer have their land use protected by traditional custom.

No project can succeed in obtaining local support unless residents are willing to accept its definition of land-use rights. Projects will fail to provide assistance with equity until the less visible uses of land which form the basis of indigenous agro-forestry systems are acknowledged and addressed in the new planning.

The Senegalese formalized land-use regulations along traditional patterns. A number of positive-looking programmes are based on this reform and it will certainly bear watching.

Educational Issues

Indigenous agro-forestry relied on fathers teaching sons, mothers teaching daughters, and wise elders being consulted for more

detailed information when a farmer had a question. The new approach is more fragmented, and sometimes quite irrelevant to the local rural family's needs. Male agricultural extension agents work mainly with men on production of agricultural cash crops; female extension agents work with women mainly on consumption issues. Extension agents may not speak the local dialect or know localized problems.

The agro-forestry agent will need a new type of training to be able to offer more responsive information in local activities. In West Africa neither forestry nor agriculture programmes are known to focus on subsistence produce, the very items upon which the survival of most rural African families depend. Foresters who concentrate on maximum wood production from forest areas are trained to protect their trees and land from local residents. Education of these agents has not focused on the need to understand or respect indigenous knowledge or on an effort to build upon the systems already in place. Agents are given "answers" to provide residents without being trained to be sure they know urgent local questions.

In an international workshop on community forestry in Francophone Africa, national planners said they saw the need to add some social science and/or agriculture to the forestry curriculums. However, they were shocked at the idea of leaving out military training or any other coursework in the current curriculum to allow for such additions. To succeed in agro-forestry there must be a genuine commitment in the new training to collaborative programming between the technical services and the local community and between the agricultural (including livestock) and forestry services themselves. There must be a recognition that since local needs and resource availability are not constant, the real goal of extension should be to give the farmers information and skills upon which they themselves may make wise choices in their ever-changing environment.

Concluding Remarks

In West Africa, there are a number of isolated agro-forestry project successes. There are projects in Senegal in which local residents have co-operated eagerly in planting trees to stabilize sand around their garden plots, planting trees on fallow land in order to raise building poles to sell, planting leguminous trees in fields to enrich the soil, and planting gum arabic (Acacia senegal) in the pasture lands. In Niger, farmers and foresters are cooperating to develop management plans in crop lands as well as the national forest

reserves to maximize the yield of secondary or tertiary products desired by local residents. Farmers in a project in the Gambia are practicing taungya in their own village woodlot and are planning to establish new lots each year so they will have some crop returns until the time the building poles or fuelwood potential of the trees is ready to exploit. These projects are encouraging.

However, the success rate could be improved with the development, not of ready solutions, but of tools which could allow technical specialists, government officials, donors and local residents to work out the programmes together. One group planning tool which is currently being tried in one form or another in several West African projects is a collaborative management agreement. This type of approach gives all parties concerned a voice in designing the activity. Ideally such plans contain the following sections: (a) identity of all participating parties; (b) long- and short-term goals of all parties; (c) adjudication of the selected land; (d) identification of timing required, and responsible party for all required inputs; (e) agreement on how, when, and to whom all potential benefits will be distributed; and (f) plan for monitoring and evaluating in which all parties can participate. This type of written and signed agreement could help all parties concerned to think through their responsibilities and rights and would allow for more active consideration of conflicts in demands on institutions and individuals. It would also allow for more local input in the planning, and more local confidence in the eventual distribution of benefits to participants.

Designers and implementers of agro-forestry activities in West Africa have a good resource in the indigenous agroforestry activities which still exist in many traditional societies. Various aspects of the indigenous systems are almost always strained and some may be dysfunctional. However, the rewards given by the systems already in place will be used by local residents to measure the desirability of any new idea. A new technology can readily succeed when it offers a better all-round return to the rural family than the technologies they are already using. However, only when benefits and shortfalls of the current system are understood can one be sure to address real questions, offering solutions with confidence that the "advanced" ideas, though perhaps marvellous on paper, are not irrelevant in the real world.

Agro-forestry as a technical academic field is new. Leaders have the potential of focusing its efforts in a variety of ways. One major choice will be to select between an emphasis on production, as current forestry and agriculture service programmes tend to do, or

concentrate on local development, as do community forest activities. It is not an issue as to whether new technology will be forbidden to one group or another or that high production will be discouraged. But obviously, for example, money spent on developing more efficient wood-fuel stoves would benefit a different audience than would research on micro-wave ovens. No one would, however, suggest denying the rich and powerful access to wood-fuel stoves. It is more the issue of whether research will focus mainly on high- or low-input technologies and of the minimum resources needed for a participant to benefit from the programme.

This selection of perspective will obviously greatly colour the way socio-economic, institutional, legal and educational issues are viewed. If agro-forestry is to become a useful tool for development with equity, efforts will be strengthened which help those who can least help themselves. Perhaps a "trickle-up" approach could be taken, assuming large agro-businesses can better afford to adapt useful conservation and production research to fit their needs, than vice versa.

In these days of limited funding many hard choices will need to be made about specific programmes and activities. It is now that the leaders forming guidelines for the future of agro-forestry must consider how to start the field along the most effective path.

Some policy implications of agro-forestry: a Ghana viewpoint

J.G.K. Owusu

Introduction

The current world-wide interest in agro-forestry is, in many respects, only one manifestation of a growing awareness of the need to make forests serve people and, in particular, sustain and enhance the socio-economic development of the often economically deprived rural populations.

This awareness it at one level illustrated in the choice of theme for several national, regional and world forestry conferences, seminars and workshops, e.g. "Forests for People" (Eighth World Forestry Congress. Jakarta, Indonesia: October 1978); "Forestry in Rural Community Development" (FAO/SIDA Regional Seminar, Chiang Mai, Thailand: December 1979); "The Contribution of Forestry to Social and Economic Development" (Eleventh Commonwealth

Forestry Conference, Port of Spain, Trinidad: September 1980). It is illustrated also by the increasing interest of international research and financial and donor agencies in community forestry programmes.

At the field level, the desire to utilize forests for the welfare of local communities and not merely for the production of industrial cellulose has found expression in several types of social forestry projects. The objective of these projects, which embrace agro-forestry, farm forests, community forests, village woodlots and urban forestry programmes is generally to supply to local communities all, or some, of the following:

- Products in the form of food, fuel, timbers, forage and secondary or minor forest products;
- A means of restoring exhausted agricultural and derelict lands; Employments;
- Raw material for rural or cottage industries;
- Avenues for people's involvement and participation in utilization and conservation of a major part of their habitat.

For many countries. this new concept of forestry would represent a major shift in emphasis or an added dimension, and would consequently have important policy, legal, institutional and other implications which would require at least as much consideration as choice of appropriate tree crop and food crop, spacing, and so on,

Where Shall Agro-foresery Be Practised?

The terminology of systems that combine food and wood production is at present much confused. In this paper, agroforestry is used to describe those sustainable systems that combine wood, arable crop, tree crop and livestock production over long term, as contrasted with earlier models, such as taungya, shamba and agrosilviculture in its original meaning, which were only temporary systems for the establishment of forest plantations.

The current National Forest Policy of Ghana which, like those of many other developing countries, heavily emphasizes forest influences and industrial forestry, has so far seen forestry as consisting in the creation and management of a permanent estate of legally reserved forests, and the temporary protection and control over the utilization of the timber resources outside the reserved enclaves. forested lands other than the reserved forests

have been only as temporary reservoirs of timber, to be converted to "non-forestry" forms of land use after logging.

If agro-forestry is seen principally only as a means of increasing total national food production, then the location of agro-forestry projects would matter only in so far as it affected distribution and marketing. If it is, however, seen as it should be - to be principally a means of enabling rural communities to meet their needs for wood, food and other products from the land while maintaining environmental stability- then it will necessarily have to be practiced close to these widely dispersed communities and therefore largely outside the reserved forests.

Besides, although there is considerable pessimism about the chances of the wet tropical forests surviving in many countries (Spears 1979) and doubts about the economic justification for tropical natural forest management (Leslie 1977), it is also widely believed that the ecological consequences of the large-scale disappearance of the tropical moist forest may be incalculable. While our knowledge of the natural tropical moist forest ecosystem, of the future of man-made forests in the tropics, and of the long-term success of large-scale settlement based on conversion of the tropical moist forest to agriculture remains as sketchy as it now is, it would seem the wiser course for foresters, such as those in Ghana, who have control over substantial areas of natural tropical moist forest to opt, for the present, for those management methods that cause as little permanent change as possible to the forest.

Thus the suggestion is that, in countries that are in a similar situation to Ghana, agro-forestry (as a permanent system of land management and utilization) should as far as possible be practiced on lands outside the reserved forests, and where it has to be employed within forest reserves it should be restricted, for the time being, to the savannah and the savannah-closed forest transitional zone. The use of tree crops such as the Shea butter tree (Butyrospermum paradoxum subsp. parkii) or even mango (Mangifera indica) as part of the agricultural component wherever agro-forestry is practiced within a forest reserve ought to be seriously considered in view of the major rationale for creating forest reserves, namely that forest growth ought to be maintained on land in reserves for the protection of this land.

The Supporting Role of Forest Reserves

Even when agro-forestry has been largely excluded from the

reserved forests, the bulk of the forest land permanently dedicated to "forestry" will have an important role to play in supporting peasant agriculture and in increasing the prosperity of the rural peoples.

First, wherever reforestation is considered desirable the taungya system should, if possible, be employed during the early establishment phase. To make the necessary impact, the agricultural component of the system will have to be taken seriously by the forest manager. The farmers will have to be given such assistance as is provided to farmers under other farming systems (e.g. access to agricultural extension officers, improved planting materials and shortterm credits) to enable them to optimize their benefits from the farm. So far the taungya farmer has been seen by the agriculturist as forming part of the forestry system and therefore lying outside his responsibility, while the forester has seen him largely as a cheap source of labour. Indeed all rural development efforts would succeed better if the supporting public institutions were organized as a team instead of as separate, often rival, units.

Second, the possibilities of underplanting or interplanting young plantations or open natural forests (savannahs) with trees and other vegetation whose leaves may be fed to livestock should be seriously pursued. The very imaginative approach in Indonesia described by Atmosoedarjo and Banyard (1978) and the grazing of sheep and cattle on pastures developed beneath Pinus radiate and Araucaria stands in New Zealand and Papua New Guinea (FAO 1973; Tustin et al. 1979) provide interesting examples.

Third, management of forest reserves ought to include actions to support rural industries such as the vegetable dyeing, the chewstick and the cane-weaving industries; the extraction of vegetable oils from such trees as the shea butter, Pentadesma butyracea. Tieghemella heckelii and neem (Azadirachta indica); bee-keeping and sericulture. In the Attebubu area of Ghana. APPLE, a nongovernmental organization working closely with the people, has shown how the destructive tendencies of honey-gathering hunters could be canalized into a thriving bee-keeping industry.

Organizational Implications

Three dimensions may be recognized: (a) organizational developments within the public forest services; (b) institutional structures to promote interagency cooperation; (c) the

identification and promotion of village institutions with which, and through which, the forestry service can work.

Forest Service Organization

In the developing tropics, forestry has been quicker to recognize the potentialities of agro-forestry than have other public agencies. In the absence of the forester, therefore, agro-forestry is much less likely to be identified by the rural peoples or by other extension agencies as a possible solution to the problems of rural land use and rural development. The general acceptance of the necessity for forest services to develop extension entities within their organizational structure is thus understandable.

The size and role of the extension unit deserves consideration, however. Among governmental agencies working in the rural areas, the agricultural services provide the most widely known example of a service with a welldeveloped extension branch. The Agricultural Service model, however, would be the wrong one for forest services to adopt. In the first place, agricultural services traditionally do not engage in farming beyond maintaining a few hectares of demonstration farms and research stations. The extension officer therefore often provides the immediate visible presence of the agricultural service in the rural areas. Forestry departments, on the other hand, traditionally manage at least the public forests. Even where they are said not to maintain extension units, therefore, the forest services have a physical representation in the villages in the technical officers, forest guards and analogous grades. In addition to their duties in the reserved and non-reserved forests, these officers have provided fairly general, even if inadequate, extension services to the rural communities.

The second reason for caution in adopting the agricultural extension services model is the widely commented-upon failure of these officers to reach the peasant farmer. By and large, even with their present limited concept of the objectives of forestry, the territorial forest officers are in fairly close contact with the people. Might it not be better to utilize the territorial forest service and give its personnel the re-orientation (from the benevolent landlord attitude prevalent under the taungya system to a commitment to develop a self-reliant people; from a "my-forest" to a "yourproject" approach; from a wood production to a development goal) and the skills to perform better as extension officers;

The suggestion then is for a small extension/social relations unit to be responsible for extension policies, planning, training and

general guidance. The ultimate territorial unit (the range, in Ghana) will be kept small and the field officer, living among and in intimate contact with the people he is supposed to serve, will be responsible for all general forestry activities, industrial or social, on reserved lands or outside.

Inter-Agency Co-ordination

In theory nothing appears simpler and more irrefutable than the requirement that forestry for local community development should be integrated within an overall ruraldevelopment framework, supported by the co-ordinated effort of the public developmental or support agencies. In practice, nothing appears more difficult to achieve than a true integration of the plans and actions of the several governmental agencies. With the trend towards making national forest services semi-independent commissions (e.g. Ghana 1980; Guyana 1979) the co-ordination of the forester's efforts with those of other governmental agencies is going to become more, not less, difficult.

The co-ordination problem arises from a complex of factors: over-centralization of governmental organization and decision-making; imbalance between the power and resources of central government and local authorities; lack of a development for people philosophy; a lack of national commitment to rural development; a fear of true democratization at the grass-roots level. In the light of such overwhelming constraints arising from causes external to the forestry organization, the forester will have to set out actively to cultivate inter-agency coordination. A highly effective tool is the multi-agency field work-shop. Even this, however, requires careful handling to prevent the other agencies seeing the agro-forestry effort only as "the forester's problem" and therefore doing no more than contributing well-meaning advice directed at the forester. University and research institutions are often anxious to participate in such field projects and workshops, and can make useful contributions.

Local Institutions

If it is accepted that agro-forestry is largely a means to a larger end of "development" and a liberated, self-reliant community - and if it is accepted that a people cannot be developed from the outside, then the local institutions for promoting change become the most important factor in a successful community forestry programme.

Three types of local institutions may be distinguished:

- The formal local development institution: e.g. the Village Development Committee in Ghana (the agency that officially co-ordinates developmental effort at the local level);
- Local forestry associations: e.g. organizations set up purposely to carry out a village programme with a "forestry" content. In Ghana there has always been a requirement that the farmers making up a taungya unit should be organized. The recognition given to the Village Forestry Associations of Korea in the forest law makes them an interesting model.
- Local voluntary associations. including some that may not originally have had a development orientation. The Village Development through Non-Formal Education (VIDED) Project operated by the People's Educational Association (PEA) of Ghana brilliantly points out the potentialities of local voluntary associations.

The PEA is a private voluntary adult education movement that has closely collaborated with the Institute of Adult Education of the University of Ghana since 1949. The aims of the VIDED Project were to train rural leaders in techniques of participatory planning, implementation and evaluation of village development projects and to provide support for self-sustaining integrated village development projects. Using a technique which involves a "one-day school" of discussion by the entire village, and playlets developed and staged by the local cultural groups that are a refreshing feature of most Ghanaian villages, a village is helped to identify its most urgent problems, the resources available in the village for solving the problem, the best approaches to seeking assistance from, for example, governmental agencies outside the village, and finally to plan and implement the project. An interesting account of how the programme operated in one village is given in Frankel (1981). The project has provided financial and material support to a co-operative unit of small-scale soap manufacturers, has an adult literacy component for villages that identify literacy as a felt need, has provided a forum for rural women to talk about their problems and learn about nutrition, baby care and cottage industries, and has pioneered community farms which are used both to generate income and to teach new farming practices or to try out little-used crops. In all cases, the Association works through not only its own local branches, but also through other appropriate voluntary organizations such as church and cultural groups.

The success obtained in this project amply reinforces the lessons

that Clark (1980) believes forestry can learn from the small farmer development projects in parts of SouthEast Asia, namely that: (a) small groups organized initially for income generation, and meeting regularly for discussion and group action can quickly develop into multi-functional, self-reliant groups; (b) small groups that successfully solve their most immediate problems quickly develop into planning groups open for discussion and long-term action; and (c) non-governmental and non-departmental agencies often do a good job of organizing the rural poor for increased self-help and self-reliance.

Forest services would do well to learn these lessons and harness the potential of the many varieties of voluntary associations already operating in the rural communities.

Legal Implications

The legal implications of large-scale agro-forestry and other community or social forestry projects vary widely from country to country. Among the most important implications would be an examination as to whether these forests would require additional legal protection against theft, illegal felling, malicious damage, etc. and whether the institutional structures identified above would require some form of legal recognition.

In Ghana, since timber utilization contracts are granted for up to twenty-five years, some agro-forestry projects may fall within areas that are subject to unexpired contracts. The clause in the standard lease agreement that grants the lessee the sole and exclusive right to cut not only the trees now growing but also those that shall thereafter be planted will need revision (Owusu 1978).

Social Implications

By keeping the land permanently under privately owned forest agricultural crops, agro-forestry is likely to accentuate the trend towards de facto individual ownership of, or permanent usufructuary rights over, communal land. (Community forests and village woodlots more likely will be communally owned and should have little effect on land ownership.)

There used to be a tendency under the taungya system in Ghana (personal observation) and in Nigeria (Olawoye 1978) for the farmers to be "stranger elements." The traditional allegiance of the farmers to the land-owning community will have to be carefully considered in order not to give rise to undesirable social

consequences.

Educational Implications

Changes in knowledge and skill requirements always have educational and training implications. Among others, Roche (1974), del Castillo (1980) and Roche and Cooper (1980) have discussed the educational implications of the widening concept of forestry for people.

Professional Forestry Education

As far as the training of the professional forester is concerned, the main implication is that forestry is no longer the largely biological and technical subject known to previous generations of foresters. The dilemma for university faculties of forestry, faced with transplanting this general implication and the bewildering array of subjects being prescribed for the "new forester" into a practical programme, is how to continue to emphasize the "scientific roots of forestry" (which lie in the biological and physical sciences, economics, and an increasing number of other sciences) - Harley 1977; to orientate the student towards the broad field of renewable natural resources management; and to continue to emphasize the vocational and applied technological aspects (forest measurements, ground and aerial survey, harvesting and processing of wood, etc.); how, in effect, to produce a graduate who is supposed to be "a forester, an agriculturist, a sociologist. and a community development worker rolled into one" (del Castillo 1980) - all in the three or four years of an undergraduate programme.

Imaginative attempts are clearly being made by university faculties of forestry, e.g. in the increasing emphasis on renewable natural resources as at Ibadan and Kumasi. Nevertheless as agro-forestry and other social forestry programmes multiply, and increasing demands are made on the forester, the time has perhaps come for a Second World Consultation on Forestry Education and Training or for smaller workshops on the educational implications of non-industrial forestry.

The "Barefoot Foresters"

The necessity for training "people's foresters" to supervise the community forests has been well established. The concept of non-formal training of local people, perhaps nominated by the community itself, to provide specialized services within the rural

communities has been pioneered by the Public Health Services from whom the forester can learn. The "barefoot forester", the local leadership and institutions, the territorially based forester rendering extension and other services, and a determined approach to the co-ordination of all support services, form an integrated whole designed to ensure that an agro-forestry programme starts as (and remains) the people's own programme.

References

Atmosoedarjo, S. and S.G. Banyard. 1978. "The Prosperity Approach to Forest Community Development in Java." Commonwealth Forestry Review. 57 (2): 89-96.

Clark, G.C. 1980. "Appropriate Extension and Communication Systems for Promoting and Sustaining Forestry in Rural Community Development." Report on FAO/SIDA Seminar on Forestry in Rural Community Development, Chiang Mai, Dec. 1979. FAO, Rome. pp. 115-120.

Del Castillo, R.A 1980. "Education and Training Needs in Support of Forestry for Local Community Development." Report on FAO/SIDA Seminar on Forestry in Rural Community Development, Chiang Mai, Dec. 1979 FAO, Rome. pp. 127-143

FAO. Forestry Dept. 1973 Forestry for Rural Communities. FAO. Rome. 56 pp.

Frankel, L. 1981. "Small-scale Catch Monkey: Non-formal Education and Public Health in Ghana." Reports Magazine, No 23, April 1981. World Education Inc.. pp. 3-5.

Harley, J.L. 1977. "Forestry Education and Research Unasylva, 29(118): 10-11.

Leslie, A. 1977. "Where Contradictory Theory and Practice Co-exist." Unasylva, 129(115): 2-17

Olawoye, O.O. 1978. "The Agro-silvicultural System in Nigeria " Commonwealth Forestry Review, 54 (3 and 4): 229 236.

Owusu, J G K. 1978 "The Law Relating to Forest Utilization Contracts in Ghana: A Historical Appraisal " Ghana Forestry Journal, 4.

Palin, D. 1980. "Institutional Arrangements to Foster Rural SelfReliance " Report on FAO/SIDA Seminar on Forestry in Rural

Community Development, Chiang Mail Dec. 1979. pp. 153167.

Roche, L 1974 "Major Trends and Issues in Forestry Education in Africa." Bulletin No. 4, Department of Forest Resources Management, University of Ibadan (Also Commonwealth Forestry Review, 54: 166 175.)

Roche, L. and R. Cooper. 1980 "Forestry for Local Community Development: Manpower, Training and Education Requirements " Commonwealth Forestry Review, 59(2): 163179.

Spears, J S 1979. "Can the Wet Tropical Forests Survive?" Commonwealth Forestry Review, 58(3) 165-180

Tustin, J.R., R.L. Knowles, and B.K. Klomp. 1979. "Forest Farming: a Multiple Land-use Production System in New Zealand. " Forest Ecology and Management, 2: 169 189

Continue

Agro-forestry aspects of the establishment of the green belt around Ouagadougou, upper volta

Peter E. Weinstabel

The Present Situation

In 1975 the German Upper Volta Forestry Project began to lay out a green belt around the capital city of Upper Volta, Ouagadougou. This ribbon-shaped plantation has an average width of more than 500 metres. It begins to the north-east of the city and is being extended annually in a north-westerly direction at an annual average rate of 120 hectares. At present 800 hectares are under cultivation, of which 720 have been afforested with rapid-growing species of trees such as Eucalyptus camadulensis (40 per cent), Azadirachta indica (30 per cent), Cassia siamea (30 per cent), Gmelina arborea (5 per cent), Dalbergia sissoo and Acacia nilotica var. adansonii. As the land had few trees it was simply cleared of the sparse secondary bush, the few old trees present (mainly Butyrospermum paradoxum and Barkia biglobosa) being retained. After the soil had been worked intensively using a crawler-type tractor (Caterpillar D7) the stand was planted at 4 by 4 metre spacing.

The land planted is traditionally considered to be part of the communal tribal land available for use by the surrounding villages.

Up to 70 per cent of the soils may be regarded as red lateritic soils which are marginal for agriculture. Without intensive tilling only very meagre yields of crops are possible and relatively long fallow periods are necessary.

However, as there is a shortage of agricultural land round Ouagadougou, with a population of more than 250,000, even the marginal sites are used continuously. There is thus no opportunity for establishing forest areas unless the population derives a direct benefit from them. Benefits, from the point of view of the local people, would include the harvesting of agricultural produce over a period of several years and the possibility of paid employment in forest activities.

Functions of the Green Belt within the Context of Overall Urban Planning

The establishment of the green belt around Ouagadougou is being pressed forward for a number of reasons, above all because of its multiple functions.

Like most African cities, Ouagadougou, with an annual population growth of 6 to 8 per cent, is growing spontaneously in a disorderly manner and without any consideration for overall urban planning. Building activities are expanding every year, and the destruction of the existing rural belt around the urban areas through the indiscriminate spread of settlements is particularly evident along the main access roads. This dense settlement leaves no space for green areas, small areas of cultivation and the rehabilitation of open spaces where this is needed, for example for erosion control. If such open areas are established at a later date considerable resettlement costs will be incurred.

The idea of establishing a green belt was primarily to lay out an afforested area around the city. This green belt. in addition to separating the city centre from the new housing and industrial estates, also has the other important functions listed below.

It has a protective function in soil conservation, in reducing the impact of the dust-laden winds which blow annually from the north-east, and in restoring the habitat of the severely depleted fauna in areas close to the city. In particular its filter effect in reducing the masses of dust carried into the city by the wind would bring a marked improvement in the quality of life of the urban population.

The recreational function of a green belt is not inconsiderable. The capital city, Ouagadougou, has only a very few small green spaces scattered irregularly through the city. The town forest at present covers only 200 hectares, the remains of the natural woodland round the city water reservoir. However, during the last twenty years this has neither received sustained tending nor has it been expanded. The town forest was therefore also included in the overall plan for the green belt.

Wood production from permanent plantations is also important, since firewood and building timber are scarce and extremely expensive for the urban population. More than 30 per cent of the income of an urban family is spent solely on firewood, a fact which clearly has an effect on the frequently poor nutrition of the African family. At present the firewood needs of Ouagadougou are transported from a distance of over 80 kilometres and are sold at prices of 2,000 to 3,000 CFA francs per stacked cubic metre (stÃ¨re). The average annual consumption is 0.8 cubic metres (solid) per head, and the daily requirement of the population of Ouagadougou is 400 tonnes of firewood (1 stacked cubic metre of firewood obtained from natural secondary vegetation weighs approximately 200 kg).

The expected rate of growth of the rapidly growing trees, on a rotation of seven to ten years, is between 2 and 4 solid cubic metres per hectare per annum, depending on the quality of the site. Since all the species planted can be propagated by coppicing, the trees can produce a commercial crop over three to four successive rotations.

Ground cover function: the areas selected for afforestation can, in the main, be considered as degraded areas without closed ground cover (meagre grass growth, only sporadic patches of vegetation). They are subject to severe damage from erosion and baking of the surface soil by the sun. In the rainy season in particular the top soil is constantly washed away. The afforestation of this land means that the direct radiation of the sun will be reduced, a layer of humus will be formed and the regeneration of soil flora and fauna will be encouraged. In this way it will be possible in the long term to restore the natural fertility of the soil while the risk of increasing destruction of the environment will be reduced decisively.

The effects of these measures on employment and income are of major importance. The annual growth of the workingage population in the urban settlement regions of West Africa is

almost 10 per cent. The creation of at least fifty permanent long-term jobs will help to relieve unemployment and provide an increased source of income. In addition, seasonal work in planting and silviculture will provide more than 500 man-days' employment each year. The workers are to be paid 60 per cent in cash and 40 per cent in kind through the World Food Programme. The Food for Work scheme provides high protein foods (fish, oil, milk powder and the like), from which the children of the workers' families in particular will benefit.

The combination of agriculture and forestry has also the function of food supply, thus benefiting the neighbouring small farmers, especially by increasing their harvest yields. Progressive soil degradation has caused decreased production of food in many places, while the rising population requires that there should be a rapid and permanent increase in supply. In addition the combination of agriculture and forestry in one land use system prevents conflicts, so that a number of development tasks can be tackled simultaneously. Activities which are technically and economically important, but are confined to a single sector, frequently magnify conflicts between different interest groups. The result inhibits development rather than promoting it. As agro-forestry satisfies the demands of a number of sectors, it is an appropriate farming system for the West African region, and an excellent example of interdisciplinary co-operation.

The Green Belt round Ouagadougou as an Agroforestry Model

Zoning

As regards right of occupancy, the Upper Volta Forestry Service has no legal title to the land required for afforestation for the "Green Belt Round Ouagadougou" project, since on the basis of traditional law the land is the common property of the village communities concerned. However, thanks to the possibility of combining forestry with agricultural crops it was possible to reach a compromise. The rights of agricultural use and the right of use of fruit and foliage (minor forest products), are still reserved to the local population, while only the subsequent logging rights fall to the Forestry Service. The afforested areas will remain legally reserved for agricultural and forestry use, thus excluding any subsequent construction development on this land. This is guaranteed by the Forestry Service as a government institution.

Following negotiations between the village authorities and the forestry officials on the tracts of land to be made available, this

land is placed at the disposition of the project, without compensation, to be used for agro-forestry, in which agricultural use of the land is requested by the population and promoted by the project. In addition priority will be given to local residents when it comes to recruiting labour.

Agro-forestry Measures

By using subsoilers to till the soil to a depth of up to 70 cm, the soils, which are frequently laterite, are loosened and their water retention capacity is increased considerably. With a rainy season lasting only three to four months (June to September) and a total precipitation of 700 mm, this is a significant measure, which more than justifies itself by increasing the percentage of natural seedings and the productivity of the land. With the spacing of trees generally used up to 1981, agricultural use of the afforested areas is possible for up to four years after planting. After this, however, it is no longer advisable as the crown canopy tends to close.

As the combined system has met with such success over the past five years, the Forestry Service is currently considering a system in which permanent farming of the land would be possible. This would involve modifying the spacing of trees to 2 metres by 7.5 metres, giving approximately the same number of plants per hectare as the old 4 metre by 4 metre spacing.

According to experience gained so far, more than 80 per cent of the people who had previously cultivated the land have continued to exercise their right to farm it. Areas not taken up by the previous cultivators are distributed by the Forestry Service to interested landless urban residents. Agreement was reached to two conditions required by the project, that an area with a diameter of 1 metre would be left clear around each of the forest plants in order to prevent excessive competition from crops, and that all the cropped areas would be tended regularly by the farmers after the seed had been sown.

Cultivation of Suitable Crops

As regards the selection of crops it was made a condition that millet varieties such as sorghum (S. bicolor) and bullrush millet (Pennisetum typhoides), should not be planted because of their suppressive effect on the trees, caused by competition for light.

The cultivation of other native crop plants was left to the free

choice of the farmers, although on this point too the Forestry Service is prepared to give advice.

The experience of the past years has shown that groundnuts (arachides - Arachis hypogea) are cultivated on 39 per cent of the Green Belt areas, the average size of the fields being 1,000 mÂ². Other species used on considerably smaller areas are okra or gombo (Hibiscus esculentus); Bambara ground-nut, or earth pea (Voandzeia subterranea); roselle. oseille de GuinÃ©e (Hibiscus sabdariffa} which supplies leaves for pot herbs, fibres for twine, and a fleshy calyx used in soups and beverages; and cowpeas, niÃ©bÃ©. (Vigna unguiculata and V sinensis) a native pulse.

Crops found sporadically are da or dah (Hibiscus cannabinus), the leaves of which are used as a pot herb, and which also produces a fibre; cotton (Gossypium herbaceum and other species); and millet (Pennisetum typhoides) and maize (Zea mays), despite the restrictions on their cultivation. In moist locations rice (Oryza sp.), tomatoes (Lycopersicum esculentum) and aubergines (Solanum melongena) are grown. Sesame (Sesamum indicum), which is not a traditional crop, is also grown sporadically.

Returns for ground-nuts are about 70,000 CFA francs (U.S. $250) per hectare and for gombo, used to make sauces, 700,000 CFA francs (U.S. $2,500) per hectare. Voandzeia and niÃ©bÃ©. according to the Regional State Development Organization (ORD), give 97,000 francs (U.S. $340) and 41,000 CFA francs ((U.S.$145) respectively, after the area deducted for the production of forest trees has been taken into account.

Advantages and Disadvantages of Combined

Cultivation

Competition between agricultural crops and forest trees is indisputable and leads to losses in growth of the trees. However this assumes that pure forest plantations are properly tended with removal of grass competition twice after planting, and that the trees are planted at the optimal time, after approximately 150 mm of rain has fallen. Unfortunately both conditions often fail to be met, for organizational and financial reasons, so that the combined cultivation of trees and farm crops also has an undisputed advantage from the forestry point of view. Experiments dating from 1976 in the green belt around Ouagadougou have shown that. when planted in conjunction with groundnuts, the tree species Gmelina arborea and Dalbergia sissoo

showed a clearly better growth at the end of the growing season when compared with trees in comparable plantations not used for agriculture. In this case the suppressive and competitive effect of the undesired grass growth inhibited the growth of the trees more severely than did the certainly more demanding ground-nut plants.

In fact experience has shown that the cultivation of groundnuts, beans and Voandzeia has a positive effect on the growth of woody plants. In particular the extra nitrogen produced by root nodule bacteria of leguminous plants has a significant, positive influence on growth. The cultivation of gombo and cotton gave less favourable results, although even in this case intercropping combined with the use of an NPK fertilizer is to be recommended. If this is applied, the tree species planted in the same plots as the agricultural crops also benefit and an increase in growth results.

To summarize, the advantages and disadvantages of combined cultivation of trees and food crops are as follows from the forestry viewpoint:

Favourable Effects of Agricultural Cultivation

- Nitrogen enrichment of the soil when leguminous plants are cropped;
- Increased water retention capacity of the soil due to frequent loosening of the top soil layer;
- Reduction of surface erosion;
- Substantial elimination of weed competition when crop areas are tended;
- Reduced fire hazard;
- Reduction of damage by browsing by domestic animals, which are kept away from the area by the local people, in order to protect their crops;
- Increased productivity per hectare.

Negative Effects

- Root rivalry between crop plants and tree species (competition for water and nutrients);
- Depletion of nutrients from the soil through annual harvests;
- Greater susceptibility of harvested areas to wind erosion;
- Attraction of domestic animals by crop residues, leading to browsing damage to the trees wherever

protective measures are lacking;
- Competition for light when tall crops are cultivated, (gombo, maize, millet).

All these investigations were undertaken from the point of view of the forester, the total net harvest returns per hectare for agricultural and forestry products not being taken into account. However there is a need for rethinking by the forestry services of developing countries. In these countries in particular the production of food has the highest priority, and to obtain self reliance in food, all possible methods of guaranteeing food supply must be fully used. Projects with an integrated approach are the only way to ensure overall development in the rural sector.

Cultivation of Indigenous Fruit and Fodder Trees

Insufficient interest has been paid in the past to the systematic cultivation of indigenous fruit trees. Plant propagation problems in the nurseries and a lack of protective measures for frequently very slow-growing trees are among the reasons why they often appear only sporadically, with young trees almost never being found. It is noticeable that the fruit trees found on agricultural land (Butyrospermum paradoxum, Parkia biglobosa and Acacia albida) are nearly always over-mature and often diseased, and only provide limited amounts of fruit and seeds.

Fruit production in subtropical and arid regions certainly should not be regarded as a "by-product" of forestry, but rather as an important way of ensuring food supplies. For this reason work began on the systematic planting of fruit trees at a wide spacing, and also along the fire break of the Green Belt. The subsequent use of the fruits, seed and foliage will be the exclusive right of the population of the neighbouring suburbs and districts of Ouagadougou, these communal rights being traditionally regulated by the Chef de Terre. We distinguish between fruit trees, which are of direct benefit to man, and forage trees and shrubs, which are used to feed cattle.

Tables 1 and 2 show the possibilities of systematic regeneration of fruit and forage trees, including the age after which a regular benefit can be derived from the trees.

TABLE 1. Fruit Trees

Period in Nursery Species	**in Years**	**Age at which Fruit**

		Production Begins
Parkia biglobosa (NÃ©rÃ©)	1-2	10
Butyrospermum paradoxum (KaritÃ©)	3 (transplanted)	30
Tamarindus indica	1	10
Adansonia digitata[a] (Baobab)	1-2	50
Bombex costatum	2	7-10
Lannea acida	1-2	10

a Experience in other countries shows that the time to produce fruit may be considerably less than this.

TABLE 2. Forage Trees

Period Species	**Age when in Nursery, in Years**	**Use as Forage can Begin**
Acacia albida	1	15
Balanites aegyptiaca	1	15
Anogeissus leiocarpus	2	20
Gardenia spp.	1	5 7
Sterculia setigera	1	5
Ficus spp.	2	15

According to an inventory of fruit trees along the green belt around Ouagadougou taken in 1981, there are on average seven fruit or forage trees per hectare. A figure of fifteen per hectare could be considered to be optimal.

Commercial Fruit Orchards

The plantation of fruit orchards on moist sites with deep soil is being encouraged by the project, although the tending and necessary irrigation for such trees during the dry period will have to be left to private initiative, especially during the first years after planting. The Forestry Service can only act in an advisory capacity

in this sector and assist in the provision of plant material. The fruit tree species valued most are Mangifera indica (mango), Psidium guajava (guajava) and Citrus aurantifolia (lime). These are cultivated in groves in so-called special locations. The produce is generally sold and only small quantities are retained for domestic requirements.

However such fruit is extremely important as a source of income for the population, especially in the urban fringe belt, and thus helps to improve their welfare.

Economic Aspects of the Combination of Forestry and Agriculture, Taking the Green Belt round Ouagadougou as an Example

As an example we shall take the tree species with the highest yield, Eucalyptus camadulensis. on a good site with deep soil, on a six-year rotation, assuming interest at the rate of 12 per cent annum.

Returns from Forestry, Considering the Income from One flotation Only' Return from sale of produce without	
harvesting costs:	230,000 CFA/hectare;
Production costs:	524.000 CFA/hectare;
Net return:	294,000 CFA/hectare (loss);
Or:	49,000 CFA/year/hectare (loss)

Returns from Agricultural Crops
Crops such as groundnuts, Voandzeia, cow-peas and gombo during the years 1977, 1978 and 1979, gave average returns of 107,500 CFA francs per hectare. Deducting seed costs of approximately 7.500 CFA, the net returns were 100,000 CFA francs per hectare.

Overall Economic Benefit during a Six-year Flotation Period
In the Green Belt the combination of agricultural crops with forest plantations increased returns considerably. Instead of forest plantations producing a deficit, a profit-earning entreprise has been created. In addition, savings to the Forestry Department in tending costs (cutting grass) are, on the average, 15,000 CFA francs per hectare per annum. These are equivalent to the labour costs for agricultural cultivation and harvesting. Hence on a six-year rotation, net returns of 50,000 CFA (U.S.$180) per hectare can be calculated.

Conclusions from Experience Gained to Date and Future Perspectives

For socio-economic reasons and its benefits to the economy as a whole, the combination of agriculture and forestry (agro-forestry) should be encouraged over large areas, in particular in the semi-arid zone. It should form an essential part of all forestry projects.

For these reasons the tree spacing used must permit permanent agricultural use without decreasing production of firewood and timber. The spacing used will depend on the climatic conditions of the zone concerned. In the case of Ouagadougou a spacing of 2 by 7.5 metres is recommended.

Further consideration should be given to the planting of fruit and forage trees at wide spacing (25 by 25 metres) to achieve a lasting, long-term improvement of food supplies for people and for cattle.

If the people in the area do not fully use the forestry green belt areas for agriculture, publicity campaigns should be mounted, particularly for the urban population, to make them aware of the possibilities.

As a result of agro-forestry the national economy will benefit from improved food and firewood supplies, and increased employment.

References

Kapp, G 1981 "Agroforstliche Untersuchungen am GrÃ¼ngurtel um Ouagadougou." Unpublished internal project data. Von Maydell, H.J. 1978. Agroforstwirtschaft - ein Weg zur integrierten Landnutzung in den Tropen und Subtropen Entwicklung und lÃ¤ndlicher Raum, Vol. 6.

Continue

Agro-forestry in shifting cultivation control programmes in India

E.S. Thangam

About 7000 B.C., according to the archaeological evidence (Childe 1956) mankind began to change its mode of life from food gathering to food cultivation, by adopting shifting cultivation which is, historically, a transitional stage towards more permanent agriculture. As the years passed, the peoples living in river valleys

advanced rapidly and brought about a number of institutional and technological changes; but meanwhile some of the people living in remote areas continued in the blind alley of shifting cultivation and failed to take part in the progress towards culture and civilization. However, in the development of a country all sections of society need to be involved, including the backward shifting cultivators, all are equally entitled to the benefits of civilization and development. For these reasons programmes for the control of shifting cultivation have become important, particularly in tropical countries, and agro-forestry has played a pivotal role in these programmes.

About India

India extends over an area of 3,287,790 kmÂ² between latitude 6Â°47' and 37Â°6' N. and longitude 68Â°7' and 97Â°5' E. The land-use pattern is as follows (in 1,000 kmÂ²): agriculture (cultivated), 1,526; forests, 750; other uncultivated land, 422; land under non-agriculture use, 162; barren and uncultivable land, 427.

Out of a total population of 684 million about 3 million people (0.44 per cent) practice shifting cultivation over 5 million hectares (1.52 per cent of the total land area) of hilly land in the country. It is practiced primarily by the people in the hills of the north-eastern states, but also, on a smaller scale, elsewhere. Appendix 1 gives details.

Shifting Cultivation Practice

In general, hill people who live in tropical regions practice shifting cultivation. After a piece of land is selected, trees or bushes are cut down partially or fully, left to dry and then burnt in situ. In the cleared land seeds of crops are dibbled into holes or broadcast, without using ploughs or animal power. When the crop yields begin to decrease after some years the cultivator moves to a new patch of forests to repeat the process, and allows the abandoned land to recuperate. After a period varying from two to twenty years, he returns to the same land for cultivation. This practice is also known as shag. "slash and burn agriculture", swidden, jhum, etc.

The system aims at self sufficiency and does not lead to any capital formation or growth. Human labour and land, in its widest sense, are the chief factors of production. It is both a labour-intensive and land-extensive system, based on low technology.

There are two divergent views about shifting cultivation one

condemning it and another, a liberal one, upholding it as a humane practice. The first one, often termed an "outsider's view", states that it dries up the springs of the hills, causes soil erosion, destroys valuable forests and adversely affects rainfall and deprives people of benefits of forest produce. The second one, often called an "insider's view", considers it as "an organic response of the people engaged in it to certain specific ecological conditions, rather than to a particular ecotechno system . . . It is crude but it is interlaced with the way of life of people who possess a crude technology and very little capital" (Bhowmik 1976). The opinion of M. D. Chaturvedi, former Inspector General of Forests (Chaturvedi and Uppal 1953), may be taken as a representative statement:

The notion widely held that shifting cultivation is responsible in the main for large-scale soil erosion needs to be effectively dispelled. The correct approach . . . lies in accepting it not as a necessary evil, but recognizing it as a way of life; not condemning as an evil practice, but regarding it as an agricultural practice evolved as a reflex to the physiographical character of land.

Shifting cultivation is mainly confined to medium to high rainfall zones, between 100 metres and 2,000 metres above sea level. It is practiced in three types of vegetation, forests, bush and grasslands.

The density of population in the area under shifting cultivation varies from three persons per kmÂ² in Arunachal Pradesh to over 300 persons in Tripura or Drissa, but people mainly depend on shifting cultivation when the population is below thirty persons per kmÂ². The study of the land/man ratio is important in working out shifting cultivation control programmes, as at a high land/man ratio, shifting cultivation does not become a problem.

The lengths of the period under cultivation and of the following fallow period vary considerably from place to place and according to the community involved and depend on population density and local environmental factors. When the increase in population upsets the ecological balance, the people cultivate the area for longer periods, reduce the fallow period, encroach upon unusable land, search for new jobs, reduce consumption pattern or migrate to other areas.

The cultivation pattern is not uniform at all places. The Noctes and Nissis of Arunachal Pradesh Pollard Macaranga denticulata trees at the time of clearing the forests. When they vacate the area they sow seeds of these trees in blank areas so that they will be available to provide house-building material and firewood when the people

return. The Wanchos leave Schima wallichii trees standing in the area. In Nagaland, alder (Alnus nepalensis) trees are pollarded and left in the area. In Madbya Pradesh, the Abujhmarhs leave mohwa (Bassia latifolia). In Andhra Pradesh, toddy palm (Borassus flabellifer), tamarind (Tamarindus indica) and mango (Mangifera indica), all of which provide food, are left by the hill people while clearing the land for shifting cultivation.

The cropping pattern also varies from place to place. In high rainfall areas, rice is grown as the principal crop, with mixed cropping of maize, millet, cotton, etc., as a secondary crop. In medium rainfall areas, oil seeds and maize are grown as the first crop, followed by millets and rice. In low rainfall areas, millets are sown along with vegetables and pulses.

This traditional system of cultivation was well adapted to the environment, and the people's knowledge of growing cereals and tree crops enabled them to maintain an ecological balance. However when the population increased they were unable to find ways of raising the longterm carrying capacity of forest lands. In addition, the population increase in the lowlands and the effects of industrialization have caused increased demand for saleable produce, and the lure of money has caused the hill peoples to increase the area under shifting cultivation. Thus the problem has become one of unprecedented dimensions, demanding an immediate solution.

The pattern of land ownership is important in the success of programmes for the control of shifting cultivation. In the north-eastern states, where no permanent land settlement has taken place, shifting cultivation is practiced in the three following categories of land ownership: (a) lands owned by villagers collectively; (b) lands owned by the chiefs who distribute lands among the individual households for shifting cultivation; (c) lands owned by individual families. In this region decisions for development can be taken quickly and this has, to a large measure, been responsible for the success obtained.

In the other states shifting cultivation is practiced either on unsurveyed areas, or as encroachments on land belonging to the government. This uncertain legal status of the land has been an impediment to the speedy and timely organization of development programmes.

Some data are available on shifting cultivation and are given below, but are far from complete.

Experiments conducted by the Indian Council of Agricultural Research, Shillong (Borthakur 1976) have shown that in hilly areas, the bottom third of the slope can be used for agricultural crops on terraces, irrigated from low dams; the middle third can be used for fruit trees and cash crops such as coffee, black pepper, big cardamom,' etc., planted along the contours; while the upper third should be used for forestry and fodder crops. This could form a basis for the planning of the land-use pattern in programmes for shifting cultivation control.

A study of 920 sq km in Arunachal Pradesh showed that the value of forest produce burnt annually in the area under shifting cultivation would be about U.S.$600,000.

Soil analysis studies in shifting cultivation areas in Arunachal Pradesh and Tripura made by Jha et al. (1976) indicated that shifting cultivation caused an appreciable change in organic matter content resulting in nutrient imbalances, and reduction in water-holding capacity, sesquioxides, iron, aluminium, nitrogen, calcium, magnesium, potassium, phosphorous, cation exchange capacity and C: N ratio. The pH value increased, i.e. the soil became more acid.

Much more information is needed on areas under shifting cultivation, changes in forest composition and soil characteristics during the fallow period, and the cropping pattern.

Agro-forestry

Agro-forestry has been defined as a "sustainable and management system which increases the overall yield of the land, combines the production of crops (including tree crops) and forest plants and/or animals simultaneously or sequentially, on the same unit of land, and applies management practices that are compatible with the cultural practices of the local population" (King and Chandler 1978). Though agro-forestry is not new, during recent years its importance has increased dramatically especially as regards its potential for optimizing land use in the tropics. Its primary aims are the production of food and wood, and conservation and rehabilitation of soil resources needed for future production, at the same time maintaining and improving the quality of the producing environment. In the coming years growing population combined with increasing pressures on finite areas of agricultural land will make the food supply situation even more precarious. There will not only be more people on the land to feed but there will also be an increasing demand for food and wood for the

growing urban populations.

According to estimates made by the United Nations Environment Programme, up to 5,000 kmÂ² of land are lost to productive use every month in the world because of erosion, flood damage, salinization and alkalization, advancing deserts and other causes. In developing countries, potential arable land is not adequate to meet the growing needs of the increasing population. In India, nearly half of the land area is subjected to water and wind erosion. Since irrigation facilities are limited, the choice for the future is limited with relatively small opportunities to bring new arable land under the plough. This calls for a new approach and in this respect agro-forestry could help to produce food and wood while conserving the ecosystem.

Sometimes it is said that agro-forestry is suitable only for marginal and brittle ecosystems. In reality it can be practiced on all types of agricultural lands, as it enables better utilization of the nutrients and water available in the soil as well as of solar energy.

Agro-forestry can be effectively practiced on lands subjected to shifting cultivation, on mountain ecosystems denuded of vegetation from biotic causes and in arid and semi-arid tracts. In agro-forestry two essential and related aims are (a) the conservation and improvement of the site, and (b) the simultaneous optimization of the combined production of a forest crop and an agricultural crop.

Through proper selection of tree species it should be possible to minimize soil erosion, to tap nutrients from deeper levels than those reached by the roots of agricultural crops, and to replace through leaf fall and fixation of atmospheric nitrogen the nutrients removed in the crop. According to E.F. Schumacher (1974) "a most marvellous 3-dimensional incredibly efficient contrivance already exists, more wonderful than anything man can make, the tree. Agriculture collects solar energy twodimensionally; silviculture collects it 3-dimensionally. "

Much research remains to be done on the choice of species, the relationship between trees and other crop plants, and the development of multiple-use trees (trees which can be used for fodder, or fruit, or other produce in addition to wood production); this includes research into genetics and breeding.

Sometimes it is said that for successful implementation of agro-forestry programmes, land hunger and unemployment should

exist among the people with a low standard of living. However, success of this system depends on the incentives given, social amenities and services provided and marketing facilities arranged. So, like any other rural development scheme, an agro-forestry programme has to be considered with relevance to the social and economic development of the people. For successful implementation of agro-forestry, the institutional requirements are also important. The curricula and syllabus in training and educational institutions need to be properly oriented by making changes. What is essential is that scientists and institutions should be "people oriented" and they should develop systems that are appropriate to the physical, biological and socio-economic conditions that prevail in the country.

Agro-forestry in Shifting Cultivation Control Programmes

Past Work

Since shifting cultivation forms part and parcel of the day-today life of tribal people in India, the policies adopted by government towards tribal people have also affected shifting cultivation practices. In the pre-independence era, two distinct approaches were adopted towards the tribal people. These were total isolation by segregation of tribal areas and de-tribalization, leading to assimilation by others. The first approach created pockets of tribal society leading their lives in their own style and manner while the second made them third-rate citizens on the lowest rung of society. After independence, the policy adopted was given in the following words of Jawaharlal Nehru: "We do not mean to interfere with their way of life, but want to help them to live it according to their own genius and tradition" (Verrier 1959).

The Jhum land Regulation 1948 of Assam was not helpful as it covered only limited areas of north-east India and was difficult to enforce. The National Forest Policy, 1952, which laid stress on weaning people away from shifting cultivation by persuasion was unable to achieve any notable success.

Efforts to regulate, control and contain shifting cultivation have been made in several states from time to time with varying results.

The taungya system, though it succeeded in West Bengal and Karala and resulted in the creation of forest villages which provided labour for forestry operations, was not successful in other states as it was unable to mobilize all the shifting cultivators and was confined to certain groups, particularly landless and lowland

migrants. The introduction of intensive methods of permanent cultivation was also unsuccessful as it failed to cater to the needs of all the shifting cultivators and was not suited to the socioeconomic life of the tribal people. Since 1970, with the emphasis on micro-level planning, the tribal sub-plan area programmes were introduced in selected places. These catered for the special needs of the tribal people with an integrated area development approach and had special funds. These programmes, by and large, were successful. Other programmes were also taken up by the state governments and the central government, like the "Pilot Project on Control of Shifting Cultivation" in eleven states in 1976-1977 and the Small Marginal Farmers Development Agency during 1975-1980.

The North-Eastern Council, Shillong, took up programmes in the north-eastern states for control of shifting cultivation. These were mainly aimed at soil and water conservation by building terraces for development of agriculture and the production of horticultural crops including tree crops. They covered an area of 11,360 hectares at a cost of U.S.$6 million.

The most remarkable feature of shifting cultivation is that almost all the varieties of cereals and vegetables, together with tree crops, are grown in the hills in a single field. This is impossible on wet plain lands. This "cafeteria system of cultivation" yields the cultivator better returns in kilogrammes of grain per man-hour of labour input than does settled agriculture. In efforts to replace this system by a better method, agro-forestry is useful as it is linked to the existing system.

Himachal Pradesh, one of the Himalayan hill states, in about six years from 1970, was able to achieve remarkable success in hill area development by growing apples as a cash crop. It evolved a three dimensional forestry combining silviculture and horticulture with animal husbandry.

In the north-east region, certain tribes of Arunachal Pradesh and Nagaland consider the possession of mithuns as a symbol of prestige and status. Most families in Mizoram and Nagaland rear pigs. The number of cattle, pigs and poultry per hundred humans is larger in the northeast region than the average of the country, as a whole, which indicates the importance of animals in the economy of this region.

The experience gained indicates that wherever an integrated area development approach involving agriculture and forestry was

made, success was achieved. Animal husbandry could supplement the income of the people. Thus agro-forestry has come to be the mainstay of the shifting cultivation control programmes. The experience gained in the various states is described in the following paragraphs.

Andhra Pradesh. 116,000 people, Konda Reddi, Samantha, and others, practice shifting cultivation on 8,392 kmÂ² in the agency area, in the north-east corner of the state, mostly on unsurveyed forest, but also to some extent on areas encroached from government forest. They generally leave useful trees such as Caryota palm, mango, tamarind, toddy palm (Borassus flabellifed and jack fruit ((Artocarpus mtegrifolia) in their cultivation area, to provide them with edible products. To take advantage of this, seedlings of these species have been supplied to them. Also, in suitable areas, besides rice and millet, cash crops such as coffee under the shade of silver oak (Grevillea robustal and jack fruit, tobacco, oil-seeds, and turmeric are grown, the produce being marketed through Girijian Cooperative Society. The centrally sponsored scheme "Pilot Project on Control of Shifting Cultivation," was taken up in 1977 and has been partially successful.

Assam. Shifting cultivation is practiced on 4,980 kmÂ² of unsurveyed land in two hill districts; the people are autonomous in character. Among the 403,000 tribal people the Karbis, besides cultivating maize, vegetables, potatoes, cotton, ginger, chillies, etc., also grow castor, tapioca, and mulberry (Mows laevigata) on which to rear silkworms. In the shifting cultivation control programme the main emphasis was in providing areas for cultivation of wet rice, and settling the people there. Shortage of flat land prevented much progress being achieved. The "Pilot Project on Control of Shifting Cultivation" was taken up in 1977 and has been partially successful.

Bihar. 61,000 tribal people, Paharias, practice shifting cultivation on private land, and to a limited extent, on land encroached from government forest, in Santhal Parganas district. They grow rice, millets, pulses and maize, and often rear tassar silkworms on sam (Terminalia tomentosa). The programme aimed at settling them on flat lands, for wet rice cultivation, has been successful where such land was available.

Madbya Pradesh. 14,000 tribal people, who are Hill Maria, practice shifting cultivation on about 3,900 kmÂ² on unsurveyed forest land in the interior of Bastar district, though this is not officially

encouraged. They generally grow rice, millets, beans, pulses, maize, sweet potatoes, chillies, oil seeds and vegetables. They protect, and often plant, the following trees: mohwa (Bassia latifolia), pales (Butea monosperma) samul (Bombax ceiba), kirni (Mimusops indica), ber (Zizyphus jujube), munga (Moringa oleifera), palms (Caryota urens, Phoenix sylvestris, P. farinifera), and siari (Baubinia vahlii). Attempts to resettle them in the valleys have only been partially successful.

Manipur. About 300,000 people practice shifting cultivation on about 1,000 km; of unsurveyed land in the hilly areas. They grow rice, maize, potatoes, yams, chillies, vegetables, millets, mustard, sugar-cane, sesame, ginger, turmeric, cotton, etc., and take care to preserve trees of commercial value in their cultivation areas. Attempts to establish permanent cultivation in the valleys have only been partially successful, due to lack of suitable land.

Meghalaya. About 350,000 people practice shifting cultivation on about 4,160 kmÂ² of unsurveyed land. Their crops include, depending on altitude, potatoes, rice, maize, millet, yams, sweet potatoes, tapioca, oil seeds, cotton, etc. They also cultivate areca nut (Areca catechu), betel leaves (Piper belle), bay leaves, black pepper, pineapples, citrus fruits, bananas, etc., and in some places rear eri silkworms on mulberry, tapioca, and castor. Permanent cultivation on terraces in the valleys has been developed, but its extension under the shifting cultivation control programme has been limited by lack of land. Coffee, under the shade of jack fruit and silver oak, has also been raised in places.

Mizoram. About 260,000 people practice shifting cultivation on about 6,040 kmÂ² in the hilly areas. They grow rice, maize, millet, sugar cane, beans, chillies, ginger, turmeric, yams, tobacco, etc. They also rear tassar silkworms on a large scale on oak (Quercus lamellosa and Q. serrate). Lack of land has limited the development of permanent terraced cultivation in the valleys, and the introduction of plantation crops such as coffee and tea has been to a limited extent only.

Nagaland. 400,000 people practice shifting cultivation over an area of about 6,080 kmÂ². Rice is the dominant crop, but millets, potatoes, yams, chillies, cotton and maize are also cultivated. They allow alder (Alnus nepalensis) to come up in their fields; besides providing small timber, charcoal, firewood, etc., it also helps to increase the nitrogen content of the soil as it has nodules containing symbiotic bacteria. They also grow the leguminous tree Parkia roxburghii for its edible beans, and raise tassar silkworms

on oak in places. Development of terraced agriculture in valley bottoms has been done only to a limited extent. There is a proposal to grow coffee over extensive areas under the shade of silver oak and jack fruit.

Orissa. 706,000 people practice shifting cultivation on about 37,000 kmÂ² in hilly areas in the northern, central and southern parts of the state, partly on unsurveyed land, and partly on land encroached from government forest. Besides rice, millets, pulses, vegetables, turmeric, tobacco, maize and oil seeds are grown, with jack fruit, bananas and pineapples among them. There has been only partial success in establishing permanent cultivation in the valleys and on the lower slopes. The planting of coffee under silver oak has been taken up over extensive areas, and it is proposed to extend this programme.

Tripura. 100,000 people practice shifting cultivation on 2,208 kmÂ², in the southern and eastern parts of the state. These areas are unsurveyed, though records have been kept of them at the village level. Besides rice, both early and late maturing, they grow millets, beans, pulses, cotton, oil seed, sugar cane and jute, with among these crops bananas, jack fruit, citrus and pineapple.

Permanent terraced cultivation has enabled people to settle in the river valleys. A shifting cultivation control programme in the hills, based on an integrated multi-disciplinary approach, has had fruitful results. Selected families have been allowed to develop orchards, reclaim land for raising field crops, and improve lakes and water areas for fisheries. They have been given housing assistance, advice on animal husbandry, primary education, and medical and other facilities over five years. In addition each family has, for seven years, been allowed to raise 1 hectare of rubber plantation under the technical guidance of the Forest Department; they have also been paid wages. This agroforestry programme has been quite successful, and there is a proposal to take it up over extensive areas (Ghosh 1982).

Arunacha/ Pradesh. 270,000 local people practice shifting cultivation over 2,486 kmÂ², on hill slopes throughout the state. Besides rice, both early and late maturing, they grow millets, maize, cotton, pulses, yams, chillies, tobacco, mustard and sugar cane, with pineapples, bananas, orange and jack fruit among them. Permanent cultivation on terraces in the valleys and on the lower slopes has been successful wherever irrigation has been provided.

Shifting cultivation control programmes have been undertaken

successfully in two fields, one by devc. ,ping areas already under shifting cultivation, and the second in a programme of retaining forests as an area for future expansion of cultivation (Thangam 1979).

In the areas under shifting cultivation an integrated area development programme was used. In general this consisted of terracing the lower third of the slopes for agricultural crops, with or without irrigation; growing horticultural and other cash crops on the middle third; and using the upper third for forestry and fodder crops and grasses. The crops to be grown were selected after a proper land-use survey. designed to get the maximum return from the land. The people were encouraged to raise pigs, and to rear fish in ponds formed by impounding water in small water courses. Wherever possible, Iow-level earth bunds were constructed and small diversion channels built to irrigate terraced areas for permanent cultivation.

Big cardamom (Amomum subulatum) was found to grow well in the area, beginning to yield from the fourth year onwards. During the first four years this cultivation provided employment for at least one person per family; from the fifth year onwards the crop yielded about U.S.$300 per hectare, rising to $600 from the tenth year onwards. Each family could plant two or three acres of this crop, and so could obtain an annual income of about $1,000, including income from other crops.

Various other development work was undertaken, in soil conservation, road construction and afforestation, among others. This was done after consultation with local village leaders, who fixed the priorities for the work. Other facilities such as health, education, etc., were provided, with the help of the local government.

The work began in the Mintong village in Tirap district in 1978, and its success has induced three neighbouring villages to offer their land for similar development programmes.

The other programme was to keep forest areas as a reserve for future expansion. In 1977, with the help of local village councils, such areas were formed into village reserved forests, and managed on a scientific basis to obtain the maximum benefit from the forests. The net profit obtained was shared equally between the Forestry Department and the village council, who utilized their share to create durable community assets. At Tafragaon, Lohit District, the management of 98 kmÂ² of such forests made it

possible to start a residential school for fifty Mishmi girls, at a cost of U.S.$50,000.

The adoption of agro-forestry principles has contributed to the success of both programmes.

Future Programmes

It has been seen that the integrated area development approach, in which agro-forestry played a leading rote, has contributed to the success of programmes for shifting cultivation control. Tribal people practicing shifting cultivation raise agricultural crops and trees simultaneously, as they need the former for food, and the latter to provide timber and bamboos for house construction, agricultural implements, fencing, etc., and also to provide a good burn when the land is opened for agriculture. They see no dichotomy between agriculture and forestry, and only wish to obtain an economically beneficial way of life from their land. The study of their methods will help to evolve better ways for the development of multiple cropping and inter-cropping, and of agroforestry.

Methods to be used in programmes for shifting cultivation control will not be uniform for all states. or for all tribal people within any state. Tribal customs differ, as do the varieties of crops which will grow in different localities. The somewhat backward Wanchoo people in Arunachal Pradesh willingly devoted their land for cultivation of big cardamoms, while in Tripura the rubber plantation programme succeeded. The object should be to produce the best return from the land, with the help of the people living there, as far as this is consistent with environmental factors.

In programmes for shifting cultivation control, unless the yield from the land was maximized through the adoption of agro-forestry methods suitable for the area, and unless the willing co-operation of the local people was obtained, unqualified success was not achieved. Programmes where plantation crops such as coffee, large cardamoms, and medicinal plants such as Dioscorea, combined with agro-forestry, brought in quick returns, were more acceptable to the people, and in addition helped to conserve environmental factors and maximize production.

In selection of areas for integrated area development programmes it is often said that such areas should be compact and easily manageable. It has been recommended that entire watersheds or catchments should be brought under treatment. This may be

technically sound, but in practice catchment areas often cover several villages, not all of which may agree to the proposed programme. So it has been necessary to set up programmes for single villages, developing the microcatchments within the village area. and ensuring development of this area as a whole. Such small and compact areas will not only be easy to handle, but will also enable results to be achieved and shown in the field in a short time.

In these programmes emphasis has been on the development of locally available resources in manpower and natural resources with the minimum investment. No import of technology is required. The use of such intermediate technology in agro-forestry programmes has been successful in the past. The low level of productivity has been improved through maximizing work opportunities to enable the people to live a better life. This will not only eliminate underemployment and unemployment, but will also help to stem the migration to urban areas. This form of development requires a capital investment of only about U.S.$1,200 per hectare, and this amount can be obtained from financial institutions on loan. In Arunachal Pradesh, a ten-year project on the above lines, in which 100,000 families will each create a plantation of a least 1 hectare of cash crops such as coffee, large cardamoms, or medicinal plants such as Dioscorea, will shortly be begun after the necessary finance has been provided by the Agricultural Refinance and Development Corporation of India, who have agreed to the proposal. Under this scheme the annual income per family will rise by U.S.$300 after the fifth year, and this income will double by the tenth year. The income of these families will be raised above the poverty line, and so Arunachal Pradesh will be the first state in India to raise the living standards of nearly 90 per cent of its inhabitants above the poverty line in such a short period.

Shifting cultivation practices are linked with the ecological, socio-economic, and cultural life of the people and are closely connected to their rituals and festivals. The theme of food production, that is shifting cultivation, is interwoven through the whole gamut of life of primitive society, whose whole philosophy of life is a product of the system of economy of people who possess only crude technology and very little capital. This is the reason why many new methods of cultivation recently introduced into tribal societies have failed to win cultural acceptance.

The rituals and festivals of the people are organized to take place at various stages of the shifting cultivation year. Unless the people

are convinced of the advantages of new agricultural methods, they will not voluntarily abandon shifting cultivation. But once they are convinced, they will change their practices, and will then also be able to adjust their ways of living, their rituals and their customs in a suitable way.

In Arunachal Pradesh the Apatanis (Furer-Haimendorf 1946) and the Monpas have more or less settled down to permanent agriculture in permanent fields, as a result of various circumstances. However this has proved no impediment to the continuation of their rituals and festivals, while their economic status has considerably improved. Our aim should be to achieve such a happy combination, through a proper psychological approach. Thus the voluntary involvement of the people in a programme, and its acceptance by them, are a sine qua non for success.

The absorption of technology is not merely a matter of calculating costs and benefits, prices of technology, costs of labour displaced, or revenue received for the product. Technology has an impact on society, the mode of living and the relationship between people and institutions. Technological change cannot be abruptly imposed. It has to be a process of evolution. However modern, however beneficial a technology, it has to fit in with indigenous culture and capabilities and harmoniously transform tradition into modernity. Erik P. Eckholm (1976) has said:

It is generally easy to recommend technological answers to ecological problems. Political and cultural factors are invariably the real bottlenecks holding up progress. Changing the relationship of man to land in the mountains, as any where else, invariably involves sensitive changes in the relationship of man to man.

Conclusion

In programmes for shifting cultivation control, agro-forestry, which aims at the production of the best return from the land through integrated area development programmes, has been successful. With the help of institutional finance, it is possible to adopt agro-forestry programmes over a span of time and with the willing participation of shifting cultivators, help them to improve their socio-economic status, and thus enable them to join the mainstream of the more advanced people of the country.

References

Bhowmik, P.K. 1976 "Shifting cultivation: A Plea for New Strategies." Shifting Cultivation in North-East India. Shillong, India.

Borthakur, D.N. 1976. Indian Council of Agricultural Research Journal. Shillong, India.

Chaturvedi, M.D. and B.N Uppal. 1953. "A Study in Shifting Cultivation in Assam." ICAR, India.

Childe V. Gordon. 1956. Man Makes Himself Watts & Co., London.

Eckholm, Erik P. 1976, "Last shangrila." The Statesman, Calcutta, 12 December 1976.

FÃ¼rer-Haimendorf, C. von. 1946. "Agriculture and Land Tenure among the Apatanis." A Man in India, XXVI.

Ghosh, A.K 1982. "Shifting Cultivation Scheme in Tripura." (Unpublished.)

Jha, M.N., P. Pande, and T.C. Pathan. 1976. "Studies on the Changes in the Physico-chemical Properties of Tripura Soils as a Result of Jhuming." Indian Forester, 105(6): 436 443.

King, K.F.S. and M.T. Chandler. 1978. The Masted Land. International Council for Research in Agro-forestoy, Kenya.

Schumacher, E.F. 1974. Sma/l is Beautiful. Sphere Books Ltd., London.

Thangam, E.S. 1979. "Shifting Cultivation in Arunachal Pradesh" Proceedings of Agro-forestry seminar at Imphal, India.

Verrier, Elwin. 1959. A Philosophy for NEFA. Shillong, India.

Appendix. Estimated Area under Shifting Cultivation, and Communities and Population Dependent on It (Primary or Partially) (1971-1975 Data)

State	Districts Affected	Name of Tribes Practising Shifting Cultivation	Estim Area Area Shift Culti Each (kmÂ

Andhra Pradesh	East Godavari, Srikakuiam and Vizag	Bagata, Jatapus, Konda Dhoras, Konda Kapus, Konda Reddi, Mukha Dhora, Samantha, Savaras and Valmiki	173
Arunachal Pradesh	Kameng, Lohit, Siang, Subansiri and Tirap	Adi (including the subgroups of Gallong, Miniyeng, Padam, Pasi, Ashing, Ramo, Simong and Tangam), Aka, Dafla or Nissi, Hill Miri, Khowa, Mishmi, Miji, Nocte, Tangsa and Wancho	920
Assam	Karbi Anglong and North Cachar Hills	Dimasa (Kachari), Garo, Kachari, Karbi, or Mikir, Khasi, Kuki, Lalung and Naga	700
Bihar	Santalparganas	Mal Paharia and Sauria Paharia	162
Madhya	Bastar	Hill Maria	81
Pradesh			
Manipur	East District, North District, Tengnoupal and West District	Anal, Chothe, Hmar, Kabui, Kacha, Naga, Lamgang, Mao Maring, Paito Simte, Tangkhul, Thadou, Valphui and Zou	600
Maghalaya	West Garo Hills, East Garo Hills, East Khasi Hills, Jaintia Hills and West Khasi Hills	Hmar, Jaintia, Khasi, and Mikir	760
Mizoram	Aizawl, Chbimtuipul and Lunglai	Chakma, Hmar, Lakher, Mizo, Pawi and Riang	616
Nagaland	Khome, Phok, Mokokchung, Hon. Tuensang, Wokha and Zunheboto	Naga, Kuki and Mikir	735

Orissa	Daudh-Khondmals. Dhenkanal, Ganjam; Kalahandi. Keonjhar. Koraput, Sambalpur and Sundergarh	Shuiya, Bondo Poraja, Didayi, Gadaba, Juang, Khond (Kuttia Khond), (Dongaria Khond), Koya, (Lanjia) Saora and Paroja	5,298
Tripura	North District, South District and West District	Chakma, Halam, Jamatia, Lushai, Mag, Naotia, Riang and Tripuri	223

Sources: North-Eastern Council, Shillong, India, state governments

Continue

The forestry situation in Thailand

Amnuay Corvanich

Thailand is a South-East Asian country with an approximate area of 514,000 kmÂ² Its population in 1982 was about 47 million. Of the total geographical area of the country 38 per cent is covered by forest, and only 25 per cent of this is classified as productive forest. The forest area has decreased at an alarming rate during the past decade. The major causes for the reduction of the forest arise from socio-economic problems and can be identified as follows:

First, Thailand is a developing country whose economy is based on agriculture: 80 per cent of the population are farmers and cultivators. Some major agricultural products such as maize and tapioca are grown as field crops cultivated on a more or less temporary basis rather than from permanent farming. Thus, the problem of cultivators encroaching into the forest is intensified when such crops are in great demand in the world markets.

Second, the birth-rate is high, with a population increase of about 3 per cent per annum. The rate of industrialization is low compared with this, causing the new generation to continue to attempt to gain a livelihood through the traditional occupation of agriculture.

Third, there is still a high percentage of illiteracy, which makes it difficult for the people to accept new farming technology introduced by government officials.

Fourth, illiteracy also accounts for the lawless habits of villagers living in remote or inaccessible areas where laws and regulations are often ignored or violated. Government authorities always deal with these violations by compromise, and because punishments given are mild, the people are undeterred from continuing to encroach upon the forests and to burn them down to grow field crops. When the soil loses its fertility they leave the old farms and move deeper into the forest to obtain new land. This practice of shifting cultivation has become a very serious problem in the country.

Fifth, some politicians take advantage of the illiteracy or low standard of education of the rural people by promising, during their election campaigns, to open new land for crop growing. After having been elected to parliament they support the encroachment of villagers upon the forest.

Sixth, as in other countries with tropical rain forest, forest management in Thailand is based on the selection system under which the trees to be harvested have to be marked by authorized forest officers. This system was appropriate in the past when the population was small, the cost of living low, and the people were more law-abiding. Now, however, the situation has changed considerably. The selection system is disadvantageous because the marked trees, which are smaller than in the past, are sparsely distributed throughout a vast annual coupe through which an extensive road network has to be constructed to extract the trees. Each year this network is extended to a new annual coupe in the forest covered by the concession. Cultivators follow these new roads into the forest and open up new areas for shifting cultivation; thus the rate of forest destruction largely depends on the rate at which areas are opened up for timber harvesting. The average size of an annual coupe is normally 10 kmÂ², and at present there are about 400 forest concessions in the country.

Finally the income of government officials is low (the minimum salary in 1982 was about U.S.$660 per annum), while the cost of living is high. Thus some people in authority are encouraged to use the marking system as a bargaining point with the concessionaires. Provided that an inducement is given, a larger number of high-quality trees are marked than is provided for in the management prescriptions. Thus this misconduct by some

authorized officials accelerates the rate of forest destruction. Forest management through the selection system breaks down, and only trees of poor quality and less desirable species are left.

The concept that forests should belong to the state has been held in Thailand since the foundation of the Royal Forest Department eighty-five years ago; this is similar to the situation in other developing countries in the South-East Asian Region, where most of the forests are state-owned. The concept of private ownership of forests has been discouraged or ignored by governments. State ownwership of forests was appropriate in the past because the birthrate was low and the demand for land for cultivation was not so high. Now the situation has changed; the population is increasing rapidly, and the need for land for cultivation is greater, but the rate of illiteracy is still high. The concept that the forest belongs to the state is related to the forest encroachment problem since people in developing countries believe that what belongs to the state should also belong to them, and so they are encouraged to violate forest laws and regulations. This applies to most developing countries, and Thailand is no exception.

Solutions and Recommendations

A number of measures to solve the problem are being tried in Thailand, as follows:

The government is trying to increase employment in industry, in order to reduce the proportion of the population who depend on agriculture. Investment in industry from foreign countries, as well as by local entrepreneurs, is being encouraged. Restrictions are being placed on the quantities which may be exported of field crops, such as cassava and maize, which are the cause of the reduction of the forest area. Universities and government agencies are carrying out research on the increase of crop production from permanent agriculture, and new, appropriate agricultural technology is being transferred to farmers in remote areas, to help them to use their existing land more efficiently.

Family planning has been promoted on an extensive scale during the last five years, by both government and private organizations. The rate of population increase has been reduced to 2.5 per cent, compared with 3 per cent five years ago. It is expected that the rate will be reduced to 1.9 per cent by the end of the next five-year plan.

Elimination of illiteracy in rural areas has been stepped up. It has

now become compulsory for every child to attend school for at least six years. More schools have been built in the rural areas. Adult education has been promoted extensively throughout the country. A new open university began work a few years ago using mass media such as radio, television and postal services to bring lectures to students. About 100,000 students were enrolled in this open university in the first year. The subject of forest conservation has been included in the curricula at every education level as the first step in a campaign for conservation of forests.

The forest village system, a modified form of agro-forestry, has been used successfully as one of the measures to reconcile the interests of the cultivators who want to encroach into the forest and the authorities who want to reforest the land. Certain kinds of cash crops are allowed to be grown in between the planted trees. Members of a forest village earn their incomes from working as reforestation workers, from selling their crops and from home industries, supervised by the chief of the reforestation unit. They can move their crops from one planting area to another, according to the planting plan for the forest trees; this is like the shifting cultivation to which they are accustomed. Each family participating in the scheme is given a piece of land on which to build a house and make a home garden. Other facilities such as electricity, water, schooling, transportation and medical care are provided. A good understanding is developed between the cultivators and the government officials. Everyone benefits from the system; the cultivators earn a higher income, and the government gets more land for forestry. Up to the present about 100 forest villages have been established throughout the country, under the supervision of the Forest Industries Organization and the Royal Forest Department.

Trials are being made of a system of forest conversion, in which small areas are clear-felled and replanted immediately; it is hoped that if this is successful it will replace the selection system. This new system will not require such an extensive road network, and will, therefore, make it easier for the authorities to prevent shifting cultivators moving into the forest. Under the new system trees of all sizes and of all species must be felled and removed from the area, and to enable the wood to be fully utilized an integrated wood industry will need to be established.

The concept of private forestry should be integrated into the forest management policy. The government must realize that the maintenance of all the forests in the country is a difficult task requiring a great number of foresters; this burden should be

shared by the private sector. The creation of non-government forests should begin with communal forests at the lowest government administrative level, that is the village. The present Government of Thailand has a scheme for creation of more opportunities for employment in rural areas. People are given employment in the construction of reservoirs, roads, irrigation systems, etc., from which everybody will benefit. The government should also use this project for the establishment of communal forests for the villages.

Apart from communal forests, lands belonging to temples and schools, and other publicly owned land, should in many cases be converted into forest plantations. The initiative for doing this could come from monks, headmasters of rural schools, or village headmen. To make the plantation more attractive small wood-consuming industries should be established; for instance, small plants to generate electricity from wood fuel for use by the community.

The government should promote large-scale commercial forestry by setting up pioneer plants, such as large-scale electricity generating plants, in areas of degraded forest. This should be followed by the declaration of all the surrounding area as a reafforestation zone. Some incentives, such as government loans at low interest, and tax exemptions, should be given. Those who are illegally occupying land could be granted ownership certificates if they took an active part in the project. To guarantee that the wood produced will find markets, local forest industries should be promoted.

The government should concentrate its own reafforestation activities in areas reserved for educational and environmental purposes, such as national parks, game reserves and watershed areas, and should leave the rest to the private sector. Here the government would be involved in the choice of species, and the giving of technical advice only.

To achieve these goals all existing restrictive laws and regulations should be revised; they alienate the local people and discourage them from participation in government activities.

In dealing with forestry problems, consideration must be given to the traditions, culture and economic status of the community, as well as to the fact that many of the people are illiterate. Appropriate technologies should be developed and introduced.

Agricultural crops introduced into agro-forestry schemes should meet market demands, suit the locality, and satisfy the cultivators. Some perennial cash crops such as coffee, cacao, and pare rubber should be promoted as these will be a source of long-term income for the farmers. Para rubber, which yields both latex and wood, should be regarded as a forest tree in order to encourage people to pay more attention to its utilization for timber.

The private sector seems more interested in short rotation, fast-growing species of trees than in long rotation, slowgrowing ones. In Thailand most exotic species grow faster than the native ones. Their wood is harder, so that they can be used both for firewood and constructional timber. The species which seem most promising as quickgrowing species in Thailand are Eucalyptus camaldulensis and Acacia auricularaeformis; these were introduced into Thailand more than a decade ago, and can be grown even on poor, arid soils in the lower rainfall areas of the country.

Constraints on the introduction of an agro-forestry element into traditional forms of shifting cultivation

J.K. Jackson

Shifting cultivation is, itself, a form of agro-forestry- the oldest form known to mankind. In the more permanent forms of shifting cultivation a period of cultivation of food crops is followed by a period under forest fallow during which the fertility of the soil is restored. This differs from certain modern forms of agro-forestry, such as the taungya system. mainly in that the forest part of the cycle arises from natural regeneration rather than from artificially planted trees.

Provided that the forest fallow part of the cycle is long enough, compared to the period under crops, such systems are effective in maintaining fertility and in preventing soil degradation, and in fact have been practiced continuously in some tropical countries for centuries. The question, therefore, is often asked "Why not try to improve shifting cultivation, rather than to eliminate it?" One possible way of doing this would be to replace all or part of the natural forest period of the cycle by artificially established plantations. The present paper considers some of the requisites for this to be accomplished successfully, and the restraints which are likely to be encountered in doing so. based largely on experience in Thailand.

Shifting cultivation is a very wide term covering a number of very different forms of land use, its essential feature being that the land is cleared and agricultural crops are grown for a limited period, which may range from one to over ten years, after which the cultivation is moved to a new site. The cultivators may or may not intend to return to the old site after the fertility of the soil has recovered.

In Thailand two extreme forms of shifting cultivation are to be found (other, intermediate forms will not be discussed here). The first is practiced by a number of tribes of Chinese origin who live at an altitude of over 1,000 metres above sea level, and who have mostly migrated into Thailand during the present century; the most numerous of them are the Hmong or Meo. These clear an area of forest primary forest where they can find it - cultivate the land for as long as economic yields of crops can be obtained, and then abandon the area. After all the land within relatively easy reach of a village has been treated in this way the whole village will be abandoned, and the cultivators will migrate in search of new lands, often to a distance of more than 100 kilometres away. The system is purely exploitative, and is analogous to a timber concessionaire felling all the useful trees in a forest tract and then moving out, without doing anything to regenerate the forest. In both cases the forest may eventually come back, though in the case of hill tribe cultivation it is frequently permanently replaced by Imperata grassland, but this is not conceived as an essential part of the system. The land is made to yield all it can, and is then abandoned, with no regard to what will happen to it in the future.

The abandoned land is often planted with trees by the Forest Department, but this is not agro-forestry as the intention is to establish permanent forestry plantations, not to prepare the land for eventual return to agricultural crops. To incorporate an agro-forestry element into the Hmong system of shifting cultivation would be virtually impossible without completely changing the system. Of course agroforestry could be introduced to replace the Hmong system, just as irrigated agriculture or commercial coffee-growing could, in some places; but this would be a change of landuse system, rather than a modification of an existing one.

The second systems of shifting cultivation is practiced by the Karen and Lawa bibles. These live at intermediate altitudes, between about 500 and 1,000 metres above sealevel, and have been in Thailand for centuries. Indeed there is evidence that the Lawa were the original inhabitants of parts of northern Thailand before the Thai came. Their system of cultivation is to cut and burn the

forest, cultivate rice for one year only, and then allow the forest to regenerate for about ten years - the period varies a little, depending on site factors - before clearing and cultivating it again. The forest is recognized by the cultivators as part of the cultivation cycle, and attempts are made to encourage its regrowth by, for instance. pollarding rather than clear felling large trees within the cultivation area, and protecting the forest against fire. Where land is abundant and population low this is a stable system, and has continued in parts of Thailand for at least 200 years. More details can be found in Keen (1972) and Kunstadter et a/ (1978).

Unfortunately as a result of increasing population and pressure on the land, the system is now breaking down. The forest fallow period is becoming shorter, resulting in invasion of Imperata cylindrica, and there has been a catastrophic drop in rice yield, from an average of about 600 kg per hectare to as low as 60 kg per hectare in some places (F.G.B. Keen, personal communication). Whereas the people used to be self-sufficient in rice, most of them now have to buy the larger part of their needs; they are becoming dispirited and apathetic and some, as a last resort, are turning to the cultivation of opium, not formerly one of their traditional crops.

How far could the replacement of all or part of the naturally regenerated forest by plantations improve this and similar situations, and what are the conditions needed for successfully introducing this change?

The first point to be considered is the choice of species for the forest plantations. The main objective of planting these trees would be to shorten the fallow cycle, by using trees which restored soil fertility more rapidly than the natural forest, and which at the same time would produce a useful product, preferably one which could be readily sold to provide income to the cultivators. The sooner they began to produce this product, the better, as for a cultivator with virtually no capital even five years is a long time to wait between planting a crop and harvesting the yield from it.

The practice of cutting down the trees and burning them before the annual crops are sown would make the growing of most fruit trees uneconomic. Guava, for instance, though it may begin to produce fruits two years after planting, only comes into full bearing at the age of eight years. There might be some scope for planting such short-lived plants as bananas and papaya after the annual crop was harvested, but neither of these is a soil-improving crop.

Growing trees for firewood or charcoal is a possibility, but this would depend largely on the market situation. Where wood is scarce and markets close at hand, this can be profitable, but where firewood can still be easily obtained from natural forest at the cost of cutting and stacking the wood only, production from plantations is unlikely to be competitive. In the future, as natural forests continue to diminish, the scope for plantations will increase, and these plantations could well form part of a cycle of annual crops followed by forest.

Another point, however, to be considered in using the forest fallow period to produce firewood is that the slash and burn system of cultivation depends on there being enough forest biomass both to produce a fierce fire, thus suppressing weeds for a year or so, and to return enough nutrients to the soil to meet the needs of the agricultural crop. If most of the firewood were removed for sale the biomass left for burning might be less than what is needed. Possible solutions for this might be to plant very fast-growing trees, which could be coppiced after say three years, and then allowed to grow for another two or three years to provide wood for burning in situ; or only to remove part of the forest crop for sale, making sure that there was enough biomass left to give a satisfactory burn.

The production of timber for wood pulp is another possibility, but for this an assured market is essential. In the Philippines cultivators are planting Albizia falcataria. a very rapidly growing, easily established leguminous tree, for sale to a paper company (Matela 1982; Spears 1980). This tree, however, is not incorporated in a shifting cultivation system, but is grown as a substitute for shifting cultivation. The scheme in the Philippines has had a good deal of success, but has involved considerable inputs in the form of credit, provision of plants, and extension work - such inputs would, of course, be needed in most agro-forestry projects. The essential part of the scheme is, however, the guaranteed market for the product as mentioned before.

Unfortunately Albizia falcataria only grows well in the humid tropics where the dry season is very short or non-existent, and has produced much poorer results in drier conditions. Other pulpwood species are, of course, available for drier areas, but so far there are relatively few countries where there is an established market for pulpwood grown by peasant cultivators. The necessity of keeping enough biomass for burning would apply equally to pulpwood plantations as to firewood plantations.

Leucaena leucocephala is another possibility, and in addition to producing wood, its leaves are very useful for feeding animals. In many countries, including Thailand, there is a growing market for Leucaena leaves as a protein constituent in animal feed mixtures. In Thailand the present market is estimated at 60,000 tons of leaf meal per year (Manidool 1981). For peasant cultivators to take advantage of this market collection would need to be organized.

Siki (1981) describes a farming system in Papua-New Guinea in which six months of foodcrops are combined with Leucaena grown on a three-year rotation, but this is in a very humid region with no dry season. Rotations in Thailand would be considerably longer than this, and even in Thailand Leucaena does not grow rapidly everywhere. Casual observations indicate that it grows well in parts of the north-east, but much more slowly in the northern region, especially above 700 metres altitude.

Thus there remains a considerable need for research into trees suitable for growing in the fallow period of a shifting cultivation system, and which have the required properties, especially of producing a marketable crop.

There are other constraints to the incorporation of planted trees into shifting cultivation systems. There will be a need for extension work, but this cannot be undertaken until solutions to the choice of species have been obtained and demonstrated. If success is achieved in this, credit may be needed in some cases. But one very important restraint to doing anything to improve shifting cultivation systems is the question of land tenure.

It is unusual for shifting cultivators to have any legal rights to land at all, even the land which is currently under agricultural crops. In many countries this cultivation is illegal, and the cultivators could, in theory, be evicted and even penalized. However, in practice, occupancy of land under crops is usually tolerated, but little recognition is given to the fact that the land under regenerating forest forms an essential part of the cultivation cycle. This land is usually regarded as abandoned; it may be converted into government-owned tree plantations, or alienated for other purposes, and the cultivators have no redress. There is little room for improvement of shifting cultivation methods in these circumstances, and if plantations were to be incorporated in the fallow cycle, it would be essential that the cultivators should have legal rights to both the agricultural crop lands and the areas under trees within the cultivation cycle. Also it would need to be clearly recognized that the trees planted by the cultivators remained their

own property.

Foresters would need to change their traditional attitudes to such problems. They are used to make plantations by employing labourers, and agro-forestry is often confined to allowing cultivators to grow crops between the planted trees. The idea of encouraging cultivators to plant their own forests, from which they would obtain the financial benefits, is a relatively new one. It is being increasingly accepted, but by no means universally so.

Assuming that a suitable species of tree had been found for including in a shifting cultivation system, how would this be introduced in practice? The first need would be the establishment of demonstration areas. Once they could be seen to be successful, cultivators could be taken to see them, and invited to consider doing similar things on their own land. Discussions with the cultivators on this might well produce useful feedback, on, for instance, how the work needed to make forestry plantations would fit in with their agricultural work year. Then if they agreed to make their own plantations they would need to be given some form of guarantee that they would not suffer financial loss - for instance, that what they grew would be purchased. In addition to technical advice, some financial assistance might be needed in the early stages, for instance by paying the cultivators wages to establish the first forest plantations, perhaps to be recovered when the crop was harvested. However the aim should be to get the cultivators to carry on the scheme on their own initiative, once they had realized that it was advantageous to them.

All this would take quite a long time, but it is far better to establish a sound basis for such schemes than to introduce them precipitately, with the very great setbacks which would be incurred if they should fail. There are possibilities of introducing agro-forestry methods into certain forms of shifting cultivation, but there are also very many difficulties to be resolved before they can be put into practice. Research into overcoming these difficulties will take time and patience, but will be well worth while if satisfactory solutions are found.

References

Keen, F G.B. 1972. Upland Tenure and Land Use in Northern Thailand SEATO Cultural Program, 1969-70.

Kunstadter, P., E.C. Chapman, and S. Sabhasri. (eds.) 1978. farmers In the Forest. East-West Center, Hawaii.

Manidool, Chanchai 1981. Protein Rich Food from Leucaena in Thailand. Asian Livestock, October. pp Go and 104.

Matela, A.G. 1982. "The Agro-Forestry Development Plan and Practice of PICOP." Paper presented to the Workshop on Agro-Forestry, Freiburg i.Br., 31 May to 5 June, 1982.

Siki, B F. (1981) "Agriculture, Fuelwood, and Conservation Programme in the Atzera Range, Lae, Papua New Guinea." Paper presented to the Workshop on Environmentally-Sustainable Agro-forestry Production with Fast-Growing, Nitrogen-fixing, Multi-purpose Legumes. East-West Center, Hawaii, 12 to 20 November. 1981.

Spears, J.S. 1980. "Forests and Man." Unasylva, 32 (128): pp. 2-12.

Continue

Forestry and the rural community

Soekiman Atmosoedarjo

Introduction

During the last decade people have become increasingly aware of the important role that forestry can play in improving the environment and in development of rural communities. Various systems of forest management and exploitation have been shown to be able to provide people living near the forests with their basic needs, such as firewood, valuable raw materials, and food, as well as water. The forest can also help to improve crop yields, income and utilization of available labour, in addition to maintaining the environment in good condition.

A number of countries are recognized for developing successful approaches to the problems of rural development. However, many other countries do not appear to know even how to begin to deal with these problems.

This paper deals with the question of the necessary and important relationships between the forest and forestry on the one hand, and the rural communities living around and alongside the forest on the other, based on experience obtained in Indonesia.

It is considered that this Indonesian experience may be of value to other countries, especially other humid tropical countries, which have more or less the same climate and other conditions.

Indonesia is a large and diverse country consisting of some 1,300 large and small islands, which extends for a distance of about 5,000 kilometres along the equator. Lying, as it does, astride the equator, it has mainly a tropical humid climate, but is also subject to seasonal monsoons which bring alternate wet and dry seasons to some areas. It has a tropical forest type of vegetation, with over 10,000 species.

With some 135 million inhabitants Indonesia is one of the most densely populated countries in the world, and is the fifth largest in population. However the population is not evenly distributed within the country. Java, the smallest of the seven major islands of Indonesia has an area of only 135,000 square kilometres and is inhabited by some 85 million people, with a density of about 630 people per square kilometre. Only about 20 per cent of the area is covered with forest. Irian Jaya, on the other hand, with an area of about 420,000 square kilometres has only 1.1 million people, so that the population density is only 2.6 per square kilometre. Ninety-eight per cent of the land of Irian Jaya is forest.

The difference in numbers of the people living in Java and those in other islands has resulted in differences in the way of life, especially of those people living in rural or remote areas. In Java, shortage of land causes the rural people to cultivate their land very intensively, while the people living in rural and remote areas of the other islands cultivate their land extensively, using traditional methods such as nomadic dry farming or shifting cultivation.

In both cases, where the population is dense and where it is light, a heavy burden is placed on the forest. Where there are dense populations people are hungry for land, and so clear the forest; where the population is light forest is subject to increasing destruction through traditional methods of farming.

Thus this paper will focus on the relationship between the forest and local communities, and the part that forest management can play in rural community development. In particular it will consider (a) the role of the forest in rural communities; and (b) the role of rural communities in the forest.

Forestry in Indonesia

The forests of Indonesia cover an area of some 120 million hectares. All are under the control of the government, and none are managed by individuals or private companies.

Forests and forestry are administered and managed by the Directorate General of Forestry, which comes under the Department of Agriculture. Under the Directorate General of Forestry are the Directorates of Planning, Marketing, Reforestation and Re-Greening, and Nature Protection and Conservation. In addition the Directorate General of Forestry co-ordinates the activities of the government-owned forestry companies, namely Perhutani and Inhutani, I, II and lilt Research and education do not come under the Directorate General of Forestry, but are controlled by other agencies.

At the provincial level, forest control and management on the ground is the responsibility of the head of the local forestry service. Smaller units are headed by forest rangers and forest guards.

Stations have also been established for the planning and development of nature protection and conservation.

In Java, the forest covers 2.9 million hectares, 900,000 of which are man-made forests. The largest part of the manmade forests consists of Jati (Tectona grandis), with an area of 600,000 hectares, followed by pines (Pinus merkusii) and Agathis (Agathis dammara). About 1 million hectares are conservation forests and national parks. The remainder is natural forest, which will later be converted into planted or man-made forest.

Outside Java the forests are mostly natural and, since 1970, have been opened to exploitation by interested parties for a period of twenty years, under the so-called Indonesian Selective Cutting System. The exploiting agencies are supposed either to replant the forest themselves, or to pay to the government the costs of replanting.

The objectives of the government in exploitation and management of the forests are:

1. To obtain revenue in the form of foreign exchange needed to support the national development programme.
2. To maintain and improve the hydrological functions of the forests, in order to control soil erosion and floods. and to preserve the water regime. Forests will also help to benefit health by improving atmospheric conditions and controlling pollution.
3. To guide the people to an improvement of their standard of living, especially those living in the areas

around the forests.

In view of the development of forest technology and the capability of the experts in forestry - the foresters - it is certain that, from the technical point of view, sound methods of forest exploitation will not be very difficult to develop. The most outstanding general problem in forest management is how to protect the forest from destruction by the peoples living near it, often without thought, to meet their simple daily needs.

Repressive methods, such as proclaiming certain acts to be forest offences and arrest of offenders are ineffective because they do not go to the root of the problem.

The fact is that in densely populated areas the shortage of land for farming has forced people to cultivate the land so intensively that there is a steady depletion of soil nutrients, with the result that the land becomes infertile and yields drop appreciably. Thus a hunger for land develops, as people strive to obtain the products they need for their daily life; this causes them to encroach upon the forest by stealing wood and illegal clearance for cultivation of land.

On the other hand, in sparsely populated regions the forests continue to be destroyed by nomadic dry farming and shifting cultivation.

The real problem is that the people living around the forests have a low, and often submarginal, standard of living. It is this problem that has to be dealt with by the authorities, especially the government agency most closely related to it, namely the Forest Service.

Dense population causes land hunger because people need land to cultivate, and to solve this problem certain steps have been taken to give people living near the forest the opportunity of cultivating forest land, so that they can increase their production of food and other necessities. This is on condition that they adopt methods and agree to accept conditions which assure that their practices to not disturb the growth of existing planted forest trees. By doing so they have more land to farm, without decreasing the area under forest.

From another point of view, in humid tropical conditions if forest covers less than 30 per cent of the land area, it is inadequate to meet requirements in controlling erosion and floods, and in regulating water supplies. In the densely populated areas of

Indonesia the proportion of forest is less than this, so a condition of "forest land hunger" has arisen.

Possibilities of increasing the area of forest land are limited by the pressure of the dense population. This has inspired the government to introduce the idea that village areas can be planted with trees of value to the people without reducing opportunities of growing food crops.

To overcome the social problems in villages around the forests a "symbiotic policy" has been developed, one which will provide reciprocal benefits to all parties involved. This policy is designed to give opportunities and guidance on making better use of forest and village land, by at the same time growing food crops, and covering the land with growing trees to improve hydrological conditions.

Making Better Use of Forest Land to Meet the Needs of the People

Forest that has been exploited and continuously managed has in fact given opportunities to local people to improve their standard of living. The conversion of natural forests to man-made forests will increase opportunities of employment in felling, replanting, and tending the young trees. When the trees are mature people will be needed to fell them, and to carry out other activities connected with forest exploitation.

Mass Intensification of Tumpangsari (Mixed Cultivation)

Tumpangsari (mixed cultivation), which is similar to taungya, has been practiced in Indonesia for 115 years. Two years after the tree seeds have been planted, farmers are allowed to grow food crops between them, provided that they do not interfere with the growth of the main species, or reduce soil fertility. Crops usually grown are dry rice, maize and other secondary crops. Cassava is not allowed to be planted because it causes a heavy drain on soil nutrients and thus impoverishes the soil.

The farmers cultivate the land between the rows of teak (Tectona grandis) and Leucaena leucocephala. The trees are planted at 3 metres by 1 metre. Within two years two crops of dry rice can be harvested, the produce of the crop belonging entirely to the farmer.

To increase yields the forest company gives advice to farmers on the use of fertilizers, pesticides and selected and recommended seed of dry rice. By using these methods yields can be increased

three- or fourfold, from 0.7 tonnes per hectare to 2.8 tonnes.

This guidance is given through extension and demonstration in co-operation with the Agricultural Extension Department, and by offering incentives such as credit to buy fertilizers and pesticides. This credit does not have to be repaid if the harvest fails. The system is called the "Mass Intensification of Tumpangsari."

This cultivation of forest land using forest tree species, legumes, and well-fertilized and tended food crops is a good example of how agro-forestry can be put into practice. It is expected that by these methods soil fertility will be maintained and improved, the standard of living of the villagers will be raised, and their participation in protecting the forest against destruction will be obtained.

In order to intensify the cultivation of the forest land, and to extend the period during which food crops can be grown, the planting distance between the tree species has been increased from 3 by 1 metres to 6 by 1 metres.

Cultivation of Fast-growing Species for Firewood

To prevent destruction of forests, especially of young plantations, certain regulations have been imposed but have been found to be ineffective. One such regulation states that local people may collect small branches (rencek), but only as much as they can carry, while they are forbidden to carry cutting tools; this has turned out to be useless, as people need much more firewood than they can collect under this rule. This firewood is needed not only for domestic consumption, but also for rural industries, such as roofing tile and brick-making, palm sugar refining, and tobacco curing, all of which use a great deal of firewood.

In addition to efforts to substitute oil for firewood, fastgrowing species have been introduced to supply firewood, such as Calliandra calothyrsa. Leucaena leucocephala, Glincidia septum (G. maculate).

Calliandra calothyrsa, a species originally from South America, yields 30 to 50 cubic metres per hectare when it is one-year old. Thereafter it can be cut every nine months, and five such harvests can be taken before replanting is necessary. It grows from five metres to some 1,500 metres above sea level, but grows particularly well at altitudes of more than 250 metres.

Fodder for Cattle

Since there are only limited areas available for free-range grazing of livestock, people are tempted to let them graze in the forest. This free grazing is usually in newly planted areas where there is young grass, but it damages the young trees. The open land where the trees have been damaged cannot prevent soil erosion during the rainy season.

Free-range grazing has become a common practice because there is not enough grass available in the villages to feed the livestock. However, by growing elephant grass (Pennisetum purpureum) - a good feed for livestock - under the forest trees people can collect the grass they need from the forest and do not need to allow their cattle to graze at will in the forest.

Medicinal Herbs

The forester in charge also advises the villagers on how to grow medicinal herbs in the forest areas, under conditions where they do not interfere with the growth of the forest trees. The increasing demand for traditional medicinal herbs will help people with insufficient land for farming to increase their income by collecting these herbs from the forest.

Beekeeping

Apiculture has been known to the people for a very long time. However they still practice a very simple method of keeping bees by using gelodog hives. These are made of coconut logs about a metre long, which are split into two halves, and after each half has been hollowed out, joined together again. The use of this method of keeping the native bees (Apis indica) produces low yields of honey of inferior quality.

In co-operation with Pramuka (the Indonesian Boy Scouts Organization), the forestry company advises the people on how to improve their apiculture through the use of modern apiaries with standardized hives, which yield more honey of better quality.

MA-MA Project

Limited areas for farming and the desire of people to be able to farm on a permanent basis has caused them to commit a number of illegal acts directed against the government reafforestation programme. Hence the MA-MA system has been introduced as an approach to community development. It is a modification of the tumpangsari (mixed cultivation) system.

The MA-MA project applies the following principles in helping the people to obtain their basic needs: (a) the project must be designed in such a way that it provides the people with a continuous opportunity to grow food crops; (b) reafforestation, the objective of the forestry organization, will only be successful if it has the support of the people involved in the project; (c) the forest trees must be managed on a rotation which will guarantee that land is continuously available for farmers to grow food crops.

Pinus merkusii has been selected for planting in the MA-MA project, because it is grown on a twenty-five year rotation.

The area to be planted is divided into six strips, as follows: strip 1 - secondary crops; strip 2 - crops with a rotation of five years; strip 3 - transitional crops with a rotation of ten years; strip 4 - other forest crops with a rotation of fifteen years; strip 5 - other forest crops with a rotation of twenty years; strip 6 - Pinus merkusii with a rotation of twenty-five years.

The strips are 50 metres wide and vary in length according to the average working capacity of the farmers.

The first twenty-five year period is a transitional one, with forest crops differing in rotation by multiples of five years; eventually all strips will have been planted with forest trees having the same rotation. This transition period is needed because the agricultural cash crops should be moved to the next strip every five years, leaving the strip which has been vacated to grow trees on a twenty-five year rotation. By the end of the transition period the whole area will be covered with the same species of tree, differing in age by periods of five years. One strip will always be available for agricultural crops.

Base Camp

It has been the practice to house workers employed in forest exploitation in camps, in the interests of efficient work. This is because the workers usually come from long distances, and the camp is generally located deep in the forest.

The new type of Base Camp, called Magersaren in Indonesia, differs from the traditional forest base camp. Labour is only recruited from long distances if there are no villages near the exploitation centre. However it is still necessary for workers, together with their families, to stay in the Base Camp, to be close to forestry activities such as felling timber and planting and

tending young forest trees. The Base Camp is thus a temporary village; it should move when the centre of activities is too far away (more than five kilometres).

Normally houses in the camps are built of locally available materials such as tree bark for walls and dry leaves for roofs. The wooden posts that support the houses can be removed and taken home by the labourers when the work is finished. However to improve the standard of life of the people, which will in turn improve their capability for work, semi-permanent houses have been introduced and built by the company. These houses, one for each family, can be moved when the time comes.

The Base Camp is completed by construction of a small mosque (mushola) and buildings with rooms for educational purposes for children and adults, and for art and cultural activities. It is expected that all the social activities of the village can be provided for in the Base Camp (Magersaren).

Housewives are also guided in current developments such as family planning, hygiene, special skills and craftsmanship. Thus all government programmes for public welfare are included, and taken good care of.

Forests for Recreation

The lack of areas for sport and education has stimulated the Forest Company to provide recreation centres, such as camping sites, for those who need them. These do not interfere with the planted trees.

Making Better Use of Village Land to Improve the Environmental Functions of the Forest

Village land around the forest can be managed to maintain and improve the environmental functions of the forest. If villagers can be persuaded to grow valuable trees on their own land, without disturbing their farming, this will be a help in protecting the land from erosion and other possible dangers.

Two important problems have to be given serious consideration, namely the needs of the villagers for water, firewood and food on the one hand, and on the other, how to give them the knowledge of how to grow valuable trees within or aound the village.

Close co-operation between the Mantri Hutan (Forest Guard) - the person who knows most about forestry and agriculture - and the

Lurah, the Chief of the Village, the person who governs the village - will guarantee that development will both increase the welfare of the people and maintain the fertility of the soil. This close co-operation between Mantri Hutan and Lurah is called MA-LU cooperation.

In this co-operation the Mantri Hutan will provide the people with the necessary plants, and advice on how to grow the trees, while the Lurah will recruit the people to participate in the project and ensure that the interests of the village and the people are not forgotten.

Water for Daily Needs and Irrigation

The principle must be to give the people what they most urgently need, and an absolute need of all villages is water for drinking and cooking.

Most villages around the forests are dry, and people usually have to walk a long distance - three to five kilometres every day, just to get water for drinking and cooking, as water sources are usually found deep in the forests.

To help the people with the problem of water, reservoirs are built to collect the water from its source, and pipes installed to bring the water to the centre of the village. The people, organized by the Lurah, are responsible for maintenance of the reservoir and pipes, and minor repairs to them. They are also responsible for the safety of the forest plantations round the water sources.

In addition, checkdams are constructed, if possible, on rivers near the villages to raise the level of water, so that irrigation of rice fields and house gardens is possible. At the same time erosion of fertile topsoil into the rivers is reduced. Fish can be raised in the dams, and people, especially the young, find them attractive for recreation.

Firewood Production

The fast-growing species used in forest plantations can also be planted in the villages. These species, such as Calliandra, Giant Ipil-lpil (Leucaena), and Acacias can be grown along village roads, around houses, around lakes, ponds and checkdams, and around the village, according to conditions of soil, climate, and elevation. Calliandra, Giant Ipil-lpil, and other legumes are multipurpose trees because: (a) they restore soil fertility; (b) the leaves are good fodder for livestock; (c) the flowers are good for bee forage, to

support apiaries.

Fruit Trees and Other Horticultural Trees

In addition to his efforts to encourage people to plant trees for firewood, Mantri hutan also has the duty of providing seedlings of fruit trees, from his permanent nursery beds. The seedlings should be of plants well-liked by the people for growing on their unirrigated farmland and in house gardens.

It is not wise to introduce "new" plants too suddenly, even though they may be of high economic value, such as cloves, hybrid coconuts and others. People are naturally hesitant to accept anything "new." The introduction of "new" plants should, instead, be done carefully and gradually at the same time as guidance is given on growing more familiar plants.

The Mushroom Project

Continuous cultivation without the use of fertilizers will make the soil infertile and unproductive. In view of the shortage of land it is necessary to introduce crops which occupy as small an area as possible - or even better, without occupying any land at all. From this point of view mushrooms are a very suitable crop.

They are grown on jamur merang (literally "mushroom straw"), The rice straw and the mushroom spawn have to be brought in from elsewhere.

After practical training by an expert especially assigned for the purpose, villagers will be able to cultivate mushrooms which can be harvested only one month after establishment. These mushrooms can be sold to increase income, or eaten to enrich the diet. After growing the mushrooms the decaying rice straw can be used as fertilizer. It will improve the fertility of the soil for second crops, or can be used for vegetables in house gardens.

This promising project has already stimulated the villagers to improve mushroom production.

Making Terraces

Where villages are on mountain slopes terraces need to be built as part of the cultivation system. Erosion is controlled by inward sloping teras bangku (bench terraces), and by planting grass on waterways, and the risers of the terraces.

Other Activities

The extension activities needed to improve the welfare of the villagers will vary with the location, the climate, and other conditions within the village. Such extension activities planting elephant grass, introducing apiculture, silk-worm rearing and so on - should take place gradually and carefully.

Conclusions

1. Forests, and the people living near them, are parts of the same ecosystem; thus rural community development quite logically falls under forest management.

2. Preservation of the forest is closely linked with the welfare of the people, especially those living near the forest.

3. Better use must be made of both forest land and village land, and fertile topsoil must be preserved; these are the two main factors in increasing prosperity in the villages.

4. Activities needed to further rural community development cannot be standardized, but must be adjusted according to the habits and beliefs of the people.

5. In rural development close co-operation is needed between the different government agencies, such as the agricultural services, services under the Ministry of Home Affairs, forestry, etc., and these together should form a development board. Co-operation is essential between this board and the Mantri Hutan (Forest Guard) and Lurah (Village Leader), who are responsible for the day-to-day execution of projects.

6. Guidance to villagers is given through extension and demonstration, and by the giving of certain incentives. It may be necessary for certain regulations to be drawn up to support project activities.

7. In order to find out the most important needs and desires of the villagers research in rural sociology needs to be undertaken.

8. A long-term programme of basic agricultural research is needed, especially applied and practical research. This will help to obtain the acceptance of the villagers to the project.

AGRO-forestry activities in a multiple-use forest management project in the Philippines

W.L. Heymann

Shifting cultivation is a serious problem in the Philippines, resulting in forest destruction, soil deterioration, soil erosion, and damage to watersheds. It is caused by population pressure, the need for food, lack of suitable agricultural land, and lack of opportunities for employment. It is not possible to control it by prosecution and punishment of the cultivators, who, with their families, number over 1 million, and in addition those who entered the forest before 1975 have been given immunity against prosecution by Presidential Decree. Thus the aim is to use socio-economic measures to encourage people to settle on the land as permanent farmers, who will not need to continuously move to new sites for slash and burn agriculture.

The Multiple Use Forest Management Project, a joint project between the Bureau of Forest Management, Government of the Philippines, and the Food and Agriculture Organization and the United Nations Development Programme began in 1978. It has an agroforestry component with the aims of rehabilitating forest land occupied by shifting cultivators, together with the development of stable agriculture, fruit-tree cultivation, and wood production. The guiding principles of the programme include ensuring the continued existence and improvement of the forest, and the improvement of the income and living conditions of the forest occupants.

Field work began in two districts in 1979, one at 500 m elevation, with 2,000 mm of rainfall spread over five to six months, and one at 1,500 m with 4,000 mm of rain falling in seven months. Work in a third, lowland, district began in 1981. The first step was to obtain information from the local people. including mayors, notables, community leaders and the cultivators themselves. This showed that the main needs felt by the forest occupants were (a) land titles, or at least long-lease permits; (b) productive trees for planting; (cl improvement of their living conditions and the welfare of their families, through schools, hospitals, etc.

The project was unable to help over land titles, though it explained the existing legal situation, but the request for help in obtaining trees led to a mutual agreement on treeplanting between the project and the forest occupants, in which the project would provide seedlings free of charge, technical assistance, and extension, while the forest occupants would stake out, plant, mulch and weed the seedlings, and protect them against fire.

The aim was for an average of twenty trees to be planted by each participant. In the lowlands soil-tolerant species were planted, such as mango (Mangifera indica), jackfruit (Artocarpus heterophyllus), pomelo (Citrus grandis), star apple (Chrysophyllum cainito) and santol (Sandoricum koetjabe). Coconuts were much requested by the cultivators, but reserved for planting in areas of good soil.

At the higher elevation the main species used was coffee (Coffee arabica) with others such as bananas, citrus and guavas (Psidium guajava). Here the programme also included bench terracing, which was done by the occupants themselves, on payment, with the assistance of project staff.

Certain fruits such as guavas and avocado pears (Persea americana) were encouraged for their nutritional value, although their market value is less than that of some of the other fruits. As a reward for good standards of maintenance and fire protection in the first year, in the second year selected trees such as grafted mangoes and dwarf coconuts were given to participants, together with improved seed of maize, groundnuts, sorghum, etc. Forage crops are also being propagated.

At the same time as participants were planting fruit trees on their land, the Bureau of Forest Development was planting forest trees, usually on land with a slope of over 50 per cent. Species used were Casuarina equisetifolia, Acacia auriculaeformis, Dalbergia sissoo, Cassia siamea, Gmelina arborea, Calliandra callothyrsus, Eucalyptus spp.. and Alnus japonica.

The rate of progress of the work is shown in Table 1.

Among difficulties encountered were the need to persuade the cultivators to plant their fruit trees at the correct distance (they tended to plant them too densely), and of the importance of ring-weeding round the trees and mulching them. Mulching is needed to improve soil fertility, to maintain humidity, to reduce weeds, and to increase soil protection.

TABLE 1. Rate of Progress of Tree Planting, 1979-1981

Year	Number of Participants	Number of Trees	Equivalent in Hectares	Averag per Pa
1979	109	6,701	48.64	61
1980	484	22,837	127.06	47

1981	479	25,954	156.82	54

At first, forest occupants were suspicious and did not believe that the project would fulfil its promises. These suspicions were removed when they received the first batch of seedlings. The keeping of promises is a key factor in this type of project, otherwise people's confidence will be lost. and the project will fail.

In the upland area the people were obtaining relatively high incomes from growing vegetables, particularly from terraced and irrigated land, and hence were less interested in tree-growing. In particular young coffee was not weeded and mulched properly, and people were reluctant to prune older plantations. They regarded coffee as a more or less natural crop, needing little tending, instead of the rather demanding crop which it is, if good yields are to be obtained.

Some forest occupants wished to extend their plantations on to public lands on which the forest had been destroyed. Solutions to this problem are foreseen, as the government has decided to give long lease permits, allowing the planting of fruit and forest trees, and is also preparing a social forestry programme linked with agrarian reform.

Another difficulty is that the forest occupants are very scattered and it is also difficult to get them to work together to plant whole slopes rather than scattered patches. The people are very individualistic and to get them to work together with others will require prolonged and patient efforts.

Despite these difficulties the project has on the whole been successful. Only 7.5 per cent of the planted trees were damaged by fire, and the target of twenty trees per forest occupant has been considerably exceeded, the actual average being fifty-four trees per participant. The number of barangays (villages) covered has increased from two in 1979 to fifteen in 1981; many more would like to participate, but the programme has been limited by shortage of budgetary allocations. The flexibility of the programme, in which the number of trees to be planted is not specified, and there is a wide choice among a number of species, is appreciated by the participants. The project however requires that holes should have been dug at the correct spacing before any tree seedlings are issued.

A cultivator who owns only twenty mango or jackfruit trees can expect to double or treble his income. This is realized by the

participants; the final proof, however, will only be obtained after some years, when the crops begin to be harvested.

Involving the forest occupants is the cheapest and fastest way to ensure restoration and rehabilitation of watersheds.

Continue

The agro-forestry development plan and practices of PICOP

Arcadio G. Matela

Origin of the Project

The Paper Industries Corporation of the Philippines (PICOP) is an integrated wood-based industry which obtains most of its supplies of raw material from its own concessions. To obtain further sources of supply for growth and expansion it has embarked on an agro-forestry programme involving landowners whose land is outside PlCOP's own concessions.

Planned agro-forestry began in the Philippines in 1967 through the initiative of Forester Nicholas P. Lansigan, then PICOP Assistant Vice-President for Forestry, in setting up the PICOP programmer. This is essentially a self-help programme for the improvement of the socio-economic welfare of the people living near PlCOP's concessions, and is especially designed to develop supplementary sources of pulpwood for the pulp and paper mill at the town of Bislig, province of Surigao del Sur, in the eastern part of Mindanao.

Planting began in a very modest way in 1968 with a few sceptical landowners who were reluctant to undertake tree farming. The writer was engaged as an Agro-Forestry Consultant by the corporation in mid-1969, when the scheme began to gain momentum. Progress accelerated considerably in 1972, when the farmers obtained their first earnings from early thinkings, and realized the great potential of agro-forestry for improving their living standards.

In 1972 also, the Development Bank of the Philippines (DBP) became interested in the project, after a study had been submitted to it by PICOP and bank officials had visited the twenty-two demonstration farms in the Bislig area. In view of the praiseworthy objectives of the project they agreed to provide financing for the participating farmers. Later the World Bank,

recognizing that the project was a viable and profitable one, took part in the financing through the DBP. It was considered that the PICOP plan would be a good model suitable for duplication not only in the Philippines but in other developing countries. A condition of the loan to farmers was the inclusion of a pulpwood marketing agreement between the farmers and PICOP.

Progress

By December 1980, 3,800 farmers were participating in the PICOP project, as compared with 22 in 1969. By that date 11.3 million trees of Albizia falcataria had been planted at a normal spacing of 4 metres by 4 metres on 22,600 hectares. Of the participating farmers, 44 per cent had availed themselves of the finance provided by DBP and the World Bank, and 56 per cent used their own resources.

With an average yield on an eight-year rotation of 250 cubic metres of pulpwood per hectare, the potential pulpwood supply will be about 760.000 cubic metres per annum. At 72.75 pesos per cubic metre, this will provide the farmers with a total of about 51.4 million pesos year (1 U.S.$ = 14 pesos).

Actually, between 1975 and 1979, before the plantations were fully mature, PICOP had already bought 660,579 cubic metres of pulpwood from farmers, valued at 37,963,500 pesos. During the first half of 1980, 119,932 cubic metres were sold to PICOP for 13,248,600 pesos.

Details of the Agro-forestry Development Plan

Under the "Agro-forestry Development Plan for Farmers" PICOP staff not only guide the farmers in growing fastgrowing trees for pulpwood, but also give advice on growing food-crops and on raising pigs, poultry, cattle and fish. The general objective of the plan is to assist in the socio-economic uplift of the people, particularly the small landowner-farmers, as well as the members of their families. through a self-help agro-forestry project. The specific objectives are (a) to assist the farmers to increase their production of cereals, vegetables, fruits, meat and fish, and (b) to assist the farmers to grow fast-growing pulpwood on their privately owned land for sale to the PICOP pulp and paper mill.

The concept of the project is to develop the land intensively, by devoting 20 per cent of the most suitable land to production of farm crops and livestock, and using the remaining 80 per cent of

poorer land for tree farming. Intercropping of annual food crops, such as rice. maize, root crops, vine crops, and vegetables, between the young trees, possibly until they reach the age of three years, is advisable. It provides the farmer and his family with additional food and cash income, and helps in weeding and maintenance of the tree plantations.

Under the loan assistance programme of the DBP and the World Bank, landowner-farmers who own from five to fifty hectares of land, outside the PICOP concession, but within 100 km distance by road from the PICOP mill, can obtain loans for the development of their land, both for food and pulpwood production.

Three methods of agro-forestry farm management are recognized. The first is used where there is existing good second-growth forest. Here on ten hectares, two hectares will be used for food-crops and livestock, while the remaining eight hectares will be managed for pulpwood by harvesting the trees which reach pulpwood size each year, and allowing the smaller ones to continue to grow. That is, a form of selection system will be practiced.

In the second case, second-growth forest is converted into cropland and tree plantation. As before, on a ten-hectare plot, two hectares are used for foodcrop and livestock production, and of the remaining eight hectares, one hectare is cleared of secondary forest and artificially planted with fast-growing trees each year. In the third case when the land is bare of trees, two hectares are planted with foodcrops, etc., and one hectare is planted with fastgrowing species each year.

Conclusions

The PICOP agro-forestry programme has shown that the private sector can be an effective partner of the government in making the hills and mountains "greener" by planting economic trees. Agro-forestry not only contributes to raising the socio-economic standards of the people, but is also an effective means of forest conservation, forest protection, maximum utilization of land, improving public relations, community development, and creation of employment.

Employment is created in preparation of land for food and wood-pulp production; in planting, maintaining, harvesting and marketing trees; and in producing, harvesting and marketing farm crops and livestock. The results are: increased family income, better education, improved health, and more active family

participation in the affairs of the community and the government.

At present, in addition to the 3,800 participant farmers, 11,400 labourers, 65 truck drivers and 65 truck helpers are employed as a result of the project, under the management of the farmers themselves, and on their payroll. Thus a relatively small-scale project has benefited 15,330 people plus their dependents. This is a great step forward in the fight against poverty.

Agro-forestry as practiced in PICOP is simple, practical, economical, profitable and duplicatable. It is hoped that such schemes will, in fact, be duplicated on a wide scale.

Appendix 1. Economics of Agro-forestry Tree Farming Project

I. Gross income from the average harvest of 250 mÂ³ of Albizia falcataria
in the ninth year, and selling at the rate of 72.75 pesos mÂ³
II. Costs
Establishment costs
1. Land clearing and preparation
2. Purchase and handling of seedlings, lining, staking, holing, planting a replanting
3. Weeding, cultivation and fertilization
Sub-total
Harvesting and transport 1. Harvesting and transporting to roadside, debarking and cutting to co metres at the
rate of 32.50 pesos per mÂ³ based on 250 mÂ³ harvest per hectare
2. Hauling from roadside to millsite (subsidized by PICOP as far as 100 k millsite)
Sub-total
Interest and taxes 1. Interest on investment of 1,700.00 pesos upon harvest on the ninth ye
(simple) per annum
2. Land tax and special educational fund for eight years at the rate of 2 p assessed value
of the land, 560.00 pesos per hectare

3. Contingencies including other government levies
Sub-total
Total cost per hectare
Net income per hectare at the ninth yeara

a Not included is the labour-income of the working Agro-forestry farmer and/or the members of his family, in such activities as land clearing and preparation, lining. staking. holing, planting and replanting. weeding, cultivation, fertilization, harvesting, hauling to roadside, debarking, and cutting of pulpwood to convenient length of 2 5 m.

Appendix 11. The Guiding Principles in the Implementation of the PICOP Agro-forestry Programme for the Socio-economic Uplift of the People or How PICOP Transfers Agro-forestry Technology to the Farmers

1. Go to the people.
2. Live among them.
3. Love them.
4. Learn from them.
5. Serve them.
6. Plan with them.
7. Start with what they know.
8. Build on what they have.
9. Learn by doing.
10. Teach by showing.
11. Not piecemeal but integrated approach.
12. Not showcase but pattern.
13. Not relief but release.
14. Mass education through mass participation.

The guideline is, "the outsider can help, but the insider must do the work." What is needed is "not relief, but release" of the latent or dormant or hidden potential of the farmer-participants. They need a challenge to do good work, but with proper guidance to do so. This is why PICOP agro-forestry is an effective self-help project for the uplift of the people.

Appendix III. PICOP Incentives for Agro-forestry Farming

1. Assistance in locating and/or acquiring vacant public agricultural lands.
2. Technical advice in determining which portions of the land are good for food cropping and livestock

farming and which for tree growing.
3. Technical advice on the preparation of land for planting, methods of planting, maintenance and management of tree farms and marketing of pulpwood trees.
4. Technical advice on the methods of planting, cultivating, processing and marketing of food crops, as well as on the raising and marketing of livestock.
5. Assistance in obtaining loans from government financing institution for tree farming and for food production.
6. Providing Albizia falcataria seedlings the cost of which is payable after the pulpwood is harvested, without interest.

Agriculture, fuelwood, and conservation farming in the atzera range, lae, Papua New Guinea

Beka F. Siki

The Atzera Range is an extensive, steeply sloping hill system adjacent to Lae, the second largest urban centre and most important industrial town of Papua-New Guinea. It has been greatly affected by migrants coming to the city from rural areas, who, when unable to obtain employment, have established squatter settlements with gardens for food, often on steeply sloping land, and have also felled many trees for fuel and house-building. These activities have resulted in excessive soil erosion and runoff, causing flood damage to roads, bridges and the sewage system of the city. Long-term effects are the loss of the capability of the land to be of use to the inhabitants, and deterioration of the ecosystem.

A team from the Australian National University, sponsored by UNESCO/UNEP, compiled a comprehensive plan for the conservation of the range. and the Government of Papua New Guinea allocated funds for implementation of this plan over a six-year period, beginning in 1979. The administration of the project is vested in the Lae City Council, with technical advice from the Atzera Range Committee. This committee is made up of representatives of the relevant government departments, universities, city and provincial governments, and other bodies.

The programme includes the following activities:

1. The establishment of fuelwood plantations on

moderately sloping areas within the hills;
2. The establishment of intensive food gardens and fuelwood cropping on the flat or gently sloping areas;
3. The ecological rehabilitation and ecological conservation of steep hillsides, eroded river and creek banks, and other degenerated areas;
4. The establishing of a distribution network for firewood and charcoal distribution.

The main objectives of this programme are to:

1. Control the environment and improve ecological stability;
2. Provide a long-term security for firewood and charcoal supply;
3. Increase food supply to urban areas;
4. Improve the nutritional status of the settlers.

Fuelwood Plantations

Firewood is the main source of energy for the pert-urban areas of Lae, and so it was planned to plant a substantial area of the less steeply sloping hill slopes with quickgrowing, easily coppiced trees producing firewood which burns reasonably well. Ability to fix nitrogen and improve the soil were additional properties to be considered. The species eventually used were Leucaena leucocephala (El Salvador Providence), Acacia auricularae form is, Eucalyptus torelliana. E. tereticornis, E. deglupta. Tectona grandis, Casuarina equisetifolia and C. oligodon. This list may be changed as the result of experience, and the availability of planting material of other species.

The spacing between the trees is 3 metres by 3 metres, and food-crops are allowed to be cultivated between them until the canopy closes, a period of at least six months. After this period the gardeners move to new planting areas. The rotation for Leucaena is two and a half to three years, and for other species four to seven years, after which the trees are felled and food crops may again be cultivated. At present 5 to 10 hectares are being planted at a time on a rotational basis, with a total of 62 hectares by June 1981.

This is a modification of the traditional shifting cultivation to which the cultivators are accustomed, with a reduction of the fallow period due to the replacement of natural forest by planted trees, while the length of the food-producing period is maintained. A system of extensive land use has been changed to a system of

continuous land use.

Intensive Food Gardens Combined with Fuelwood

This method is used on lands with slopes up to 30Â°. Leucaena is planted in rows 3 to 4 metres apart, with 1 metre between the plants in the rows. Each farm has an area of 2 hectares divided into 5 plots of 0.4 hectares each, and the individual plots are subdivided into family units, the size of each family plot depending on the numbers of families who previously cultivated in the area.

Food crops are grown between the trees for at least six months, or until the shade of the trees becomes too heavy for crop growth. The cultivators then move to the other plots in succession, until the first plot is three years old and the fuelwood can be harvested, when the cycle begins again. In the two oldest farms, first planted in 1979, the fifth planting was due to be made in January 1982, and the first fuel crop harvested in July 1982, when a new cycle would begin.

The objectives of the system were to demonstrate the production of traditional food crops between rows of Leucaena; to demonstrate contour-mounding, incorporating the use of compost; to observe how traditional subsistence gardeners adapted to a new farming system; to demonstrate controlled land use, conservation, and the maintenance of soil fertility; to improve food and firewood production; and to serve as a basic model for extension to other areas.

As more families move out of their gardens on sensitive sites more land will be needed for this type of farming, and additional sites for this are being acquired.

Rehabilitation of Degenerated Areas

These include eroded sites on creek-banks, hillsides and peaks, foot-trails, landslips, areas infested with kunai (Imperata) and disused gardens.

In these areas deep-rooting trees and shrubs are being planted, including in addition to fuelwood and timber species, some plants which produce food and other traditional products such as medicines and fibre. A list of species suitable for different ecological zones, and the products produced from them has been prepared, including details on propagation techniques.

Ecological Conservation

Conservation reserves are being established to protect vulnerable places such as land close to streams, creeks and water courses, steep slopes, ridge crests and cliffs. Protection is also given to remaining stands of undisturbed forests and individual reproductively mature trees, and to endangered plant and animal species. The objectives are to arrest degradation, to sustain diversity of ecological relationships (including human), and to help to safeguard self-regulating ecological processes such as nutrient recycling and population stability.

Network for Distribution of Firewood and Charcoal

A beginning has been made in building small firewood sheds in the main settlement areas round the foot of the hills, which will later be supplied from one or two central holding depots. These sheds will be eventually stocked with the produce of the new plantations, but until this is available offcuts and wood waste from a local sawmill are being used. Between 1979 and June 1981, 450 tonnes of firewood was distributed through the sheds; demand has been high, but there are some transport problems.

Experiments and Trials

Experiments have been laid down on spacing of different fuelwood trees, and on the interaction between Leucaena and sweet potato (Ipomaea batatas) when planted together. Research is taking place on methods and strategies for soil conservation, and surveys are being made on nutrition and food-crop production.

Composting and Community Food Gardens

The Lae City Council has a scheme for production of compost from garden refuse, brewers' grains, chicken and cow manure, and sawdust, for use in the Atzera Hills. Present production is 2,000 tonnes per year, with plans to increase this to 10,000 tonnes.

The council has also established twenty hectares of community food gardens on wasteland in and near the city, and people who cannot be given garden lands on ecologically suitable sites in the hills are encouraged to cultivate there.

Conclusion

The Atzera Range Conservation Programme is based on the use of agro-forestry techniques, and sound ecological planning. More

knowledge of the interactions between soils, plants, climate and socio-economic factors is however needed to permit further refinement and improvement of the systems.

Bibliography

Harris, J.A. 1979. "The Atzera Project: Ecological Management of the Atzera Range adjoining Lae, Papua New Guinea. An Initial Proposal." Technical Paper No. 4 of the Papua New Guinea Human Ecology Project (PNGHEP).

Newcombe, N.K. and T. Pohai. The Papua New Guinea Human Biology Programme, "Lee and its Hinterland". Man and the Biosphere Project 11, Integrated Ecological Studies of Human Settlements. UNESCO/UNEP Centre for Resource and Environment Studies ANU, Canberra.

Siki, B.F. and V. Dube. 1979. "Food Production in the Lae City Area." Paper presented at the Workshop on Urban Food Supply; Waigani Seminar, 24 28 September 1979.

Problems of agro-forestry in land-use planning

T.C. Sheng

Introduction

As a science agro-forestry is relatively new, although in . practice it has been used in some countries for centuries. The definition of agro-forestry covers a wide range of activities including at least agri-silviculture, silvopasture, agro-silvopasture and multipurpose forest production (King 1980). As agro-forestry is a new and many-sided discipline it gives rise to certain problems in land-use planning and policy-making. This paper concentrates on discussion of the following basic problems: What kind of land should best be used for agro-forestry? Is agro-forestry alone sufficiently effective in protecting the environment? What problems are faced in planning agro-forestry, including strategies, farmers' participation and government inputs?

Suitability of Land for Agro-forestry

Classification Criteria

In land-use planning, the first task encountered by the planners is to formulate the criteria by which land is classified for optimum use. The concept of proper or rational land use cannot be realized

unless certain scientific and practical criteria are available for classifying each piece of land. Criteria vary from country to country. However they are mostly based upon the physical conditions of the land together with the socio-economic conditions of the particular country in which they are to be applied.

Are such criteria necessary in classifying land as suitable for agro-forestry? The answer must be in the affirmative. During the Latin America Soil Conservation and Soil Management Workshop in Peru, this subject was discussed and it was recommended that land-use maps of the region should include potential zones for agro-forestry.

Although the activities included in agro-forestry are very diverse they cannot be applied on all types of land by all people. On the other hand, it is too conservative to think that agro-forestry should be mainly confined to areas under shifting cultivation or within the boundaries of government forest reserves.

If we do agree that certain areas should best be earmarked for agro-forestry, for the benefit of the people and the nation, then the next question is: Do criteria already exist for classifying land as suitable for agro-forestry?

These criteria. as in all other systems of land capability or land suitability classification, should include the factors as in Table 1.

TABLE 1

Site	**Land Physical Properties**	**Socio-economic Conditions**
Elevation	Soils	Present and traditional
Climate	Slope	land use
	Erosion	Population pressure,
		labour and employment
		Other macro
		socio-economic
		conditions

The classification and use of land should serve the people and the country for generations to come, and not aim only at short-term

benefits. In other words, all land should be used within the limits of its capability and in accordance with the principles of resource conservation.

Examples

Two examples are briefly introduced here: one from northern Thailand and the other from Jamaica. In both, the criteria are quite straightforward.

Narthern Thailand The criteria employed in Northern Thailand for classifying land within a 43,000 hectare watershed as suitable for agro-forestry were as follows:

Slope:
From 19Â° to 27Â° (35 to 50 per cent).
Soils:
Depth 50 cm and over; no permanent use limits such as the soil being too wet or too stony.
Erosion:
No severe erosion such as dissection by gullies.

The rainfall in the watershed averages about 1,500 mm and the elevation ranges from 300 m to 1,700 m. There is no need to spell out the socio-economic conditions of northern Thailand as several UNU mettings have been held at Chiangmai in recent years and many papers have discussed these conditions in great detail. However, the watershed is essentially a forest watershed and the main objective of the classification into land suitable for various types of use, including agro-forestry, was to rationalize land use and promote integrated development. The final result showed that about 18 per cent of area of the watershed should be designated for tree crops and agro-forestry.

Jamaica
Jamaica is a small Caribbean island in the tropics. Of its total area of 11,400 kmÂ², 75 per cent is rugged. Most small farmers live in steep watersheds.

A land capability classification scheme including tree crops and agro-forestry has been introduced in Jamaica since the 1970s (Sheng 1972). At present, the Government of Jamaica. with the support of FAO, UNDP and the Norwegian Government. is classifying six municipal watersheds around the capital of Kingston for a bankable project. The criteria for land for agro-forestry are given in Appendix I.

Justification

In considering the above examples. people may wonder why agro-forestry should be confined to slopes or rather to steep slopes. The reasons are many. From the national planning point of view, flatter lands and good lands should be used intensively for producing agricultural crops, either for export or for domestic use. From the farmer's standpoint, the same principle applies. Better soil and gentle slopes are used for vegetables or staple food crops while steep slopes should be for tree crops or trees. Since the world population will increase to 7 billion by the beginning of the next century and more marginal lands with steep slopes will be brought into cultivation (Biswas and Biswas 1978, Pimental et al. 1976) it is rather a luxury to use good, gently sloping land for agro-forestry or tree crops. According to a seminar report, 50 per cent of the Andean, Central American and Caribbean areas consists of steep slopes.

From the standpoint of resources conservation, steep slopes should be put under permanent or semi-permanent vegetative cover. If agro-forestry should occupy gentle lands and the cultivation of annual crops should shift on to steep slopes, this kind of land use would without any doubt result in tremendous problems in erosion, management and costs.

Figure 1 is a profile showing the zone suitable for agroforestry in relation to other uses. This is based on experience from hilly developing countries. In large and flat countries, agro-forestry seems to be better suited to marginal landa.

Effectiveness for Environment Protection

On Erosion Control

All agro-forestry systems should conserve and improve the sites (King 1980). From the point of view of erosion control an ideal agro-forestry system should provide a quick, complete and multi-storey vegetative cover to protect the land from rain-splash erosion and minimize soil detachment. Otherwise agro-forestry cannot be regarded as wise or proper land use, especially on steep slopes in humid tropics.

In the United States and several Central African countries, the tolerable soil loss rates are from 2.5 to 12.5 tonnes per hectare year (Hudson 1971). When the erosion rate of a particular field is known, every effort has to be made to reduce the soil loss to

tolerable limits by applying various conservation treatments. Much soil conservation research in the tropics and sub-tropics has shown that the farmers' traditional methods of cultivation on moderate slopes produce an average loss of 150 tonnes of dry soil per ha per year (Sheng 1972). Even with the most intensive form of conservation treatment such as bench terraces the soil loss can at best be reduced by 90 to 95 per cent, or to 10 to 15 tonnes per hectare per year (Sheng 1981).

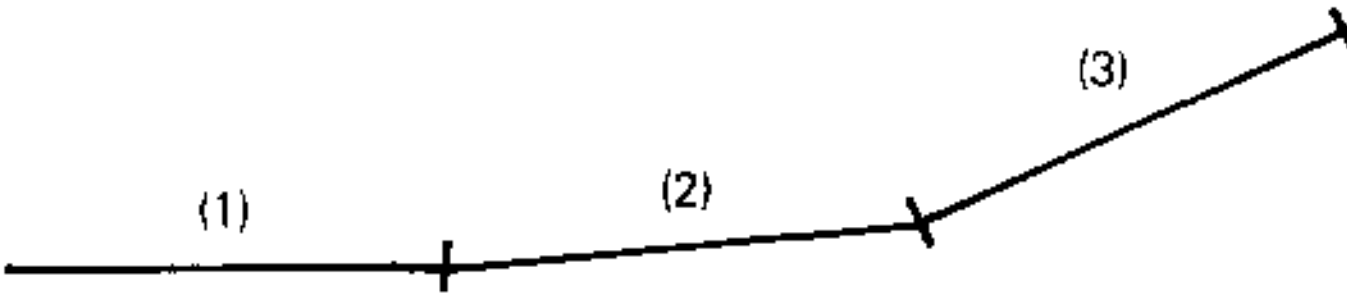

FIG 1: Hypothetic Profile Showing Relative Sites of Land Use

(1) Flat lands: For agricultural crops.
(2) Gentle slopes: Up to 7Â° (12 %). For agricultural crops; planted with simple agronomic conservation measures, i.e. contour and close planting, strip cropping, vegetative barriers, etc.
(3) Moderate slopes: 7Â° to 25Â° (12-47%). For agricultural crops; planted on various terracing systems, i.e. hillside ditches, intermittent terraces, bench terraces, etc.
(4) Steep slopes: 25Â°-30Â° (47-58%). For agro-forestry and orchard

crops; planted with individual basins, orchard terraces and/or the establishment of proper vegetative cover for erosion control.
(5) Very steep slopes: 30Â°-40Â° (58-84%). For forestry.
(6) Cliff and non-operable slopes: 40Â° (84%) and over. Protection forest or recreation.
N.B. The slopes suitable for each category of land use may vary according to the erodibility of soils on different sites. The important thing is the relative position of the various types of land use along the profile. Category (1), (2) and (3) land is to be classified for use as pasture when the soils are shallow or have other use limits.

How effective are various agro-forestry systems in terms of erosion control? Can the vegetative cover of the agroforestry system be developed to fully protect the soil? What will be the best combinations of trees and crops in space and time to minimize erosion and increase production? More research is surely needed to find out the answers.

In many tropical countries, fast-growing trees or shrubs are now being introduced by planting them across the slopes leaving alternative belts for crop cultivation. Problems of shading crops and erosion of the cultivated belts are still unsolved.

For effective erosion control, agro-forestry probably needs to be supplemented with simple soil conservation measures such as discontinuous types of terraces, mulching, individual basins, etc., wherever possible.

On Water Conservation and Others

The results from many experimental catchments in various parts of the world show that trees generally use more water than agricultural crops (Hewlett 1971; Pereira 1981). They extract moisture from considerable soil depths which the roots of ordinary crops cannot reach.

Reforestation with some pine species has been proved to reduce water yields from given areas or from whole watersheds (Douglass 1974; Kunkle 1975; Reigner 1970). Certain fast-growing tree species may have even more adverse effects on water resources. For instance, some species of Eucalyptus have been reported as drying up springs and depressing ground water levels. Yet Eucalyptus has been used in many countries as one of the major tree species in agro-forestry systems.

In municipal watersheds for domestic water supply, or in the source areas for irrigation water, the introduction of fastgrowing and water-loving tree species may not be entirely desirable.

There may be other adverse effects of certain tree species. Behmel and Neumann (1981) mentioned that in Rwanda certain tree species are not used for inter-cropping because of emission of plant-toxic substances (allelopathy). Many foresters in Taiwan believe that teak (Tectona grandis) has adverse effects on the site. In El Salvador, an experiment showed that teak plantations with no undergrowth lost between 64 and 82 tonnes of soils per hectare per year (Michaelsen 1975). Tree species should therefore be selected with great care.

The competition for light, moisture and nutrients between trees and crops interplanted between them is also an important subject for urgent study.

Problems of Development

Planning Strategies

In developing agro-forestry in a country, some difficult management problems will arise at the planning stage. The following are only a few of the obvious ones:

- What is the target group for which such activity is planned? Is it subsistence farmers aiming at self-sufficiency or progressive farmers involved in marketing and commercialization? In commercial farming, the diverse nature of the products, harvested in relative small quantities and at different times, will surely create difficulties in handling, storing, transportation, marketing and processing.
- What level of management and production is expected from those farmers who practice agro-forestry? Since the system can sometimes be complicated, can we expect the small and illiterate farmers to invest their labour, materials and other inputs at the correct time, and to maintain the system properly. If the level of management, and hence of production, is low, the programme is unlikely to attract financial support nationally or internationally.
- What kind of implementation period or planning templated, or is agro-forestry to be permanent or transitional? Many such activities in forest reserves are

transitional. In these the ultimate goal is usually reforestation. Outside forest reserves, this type of mixed land use is often semi-permanent. Weaver (1979) has pointed out that the system is not a substitute for intensive agriculture or forestry. When the economy of a country is advancing, areas under agro-forestry will probably be either left to forest or be developed into commercial crop lands or orchards depending on the owner and the site. Many examples of this can be seen in advanced developing countries and in municipal watersheds. The traditional tendency of agro-forestry gives rise to an element of uncertainty to policy-makers and land-use planners.

Farmers' Participation

Probably this is one of the most crucial problems in developing agro-forestry in any country.

On public lands and in forest reserves farmers are to some extent prepared to accept the taungya system, the degree of acceptance being dependent on how the forest authorities handle the case. However in northern Thailand, as in central Taiwan, this acceptance has been limited. The problem seems to lie with the land-use history of the site. A new area of afforestation in which farmers are invited to practice taungya will cause no problems, but planting old cultivated fields with trees will not be welcomed by the squatters. Recent solutions to the squatter problem in these countries rely mainly on the declassification of forest lands, and re-allocation of gentle slopes within the reserves for cultivation by the former squatters or on setting up forest villages.

To bring trees or tree crops into private cultivated fields is much more difficult. For subsistence farmers, this means reduction of their traditional cropping areas or delay in obtaining income from their procedure. For progressive farmers, planting trees may mean adding obstacles to their farming, especially under mechanization.

To attract more farmers to agro-forestry we need to look at it from their standpoint to see whether the systems to be introduced are acceptable. If they are not, we need to modify them or derive new ones to suit the local conditions. Farmers' participation cannot be disregarded if agroforestry is to succeed.

Incentives and Extension Needs

Development of agro-forestry needs higher inputs in incentives and extension work than, say, soil conservation or cropping programmed, for the simple reason that trees or tree crops require more years to yield returns and the techniques involved are rather complicated.

In Jamaica, for instance an intensive ongoing soil conservation programme in which farmers are given 75 per cent of the land treatment cost as an incentive has not attracted the participation of too many farmers. The ratio of extension officers to farmers is 1: 200 which is very high by any standard.

Land treatment such as bench terracing with top-soil preservation and proper management can yield higher crop production in the same year. As an example, in Jamaica, at the soil conservation demonstration centre at Smithfield, yam (Dioscorea spp.) production was doubled on the newly constructed terraces in the year of construction and tripled in the second year and onwards. When establishing trees or tree crops farmers have to wait for at least four or five years to get returns. To compensate for the land occupied by trees, and the much delayed income, greater incentives will be needed.

Extension of agro-forestry work not only needs concentrated intensive programmed, but also requires many extension officers well equipped with knowledge of agriculture, forestry, horticulture, pasture, etc. There may be a problem in finding and training such personnel.

Final Remarks

If agro-forestry is used only as a means of solving the problems of shifting cultivation or squatting on government lands, its implementation is usually less difficult. If, on the other hand, it is to be developed as a permanent land-use pattern on private lands, the problems are considerable.

The queries raised in this paper are a challenge to all of us, whether land-use planners, policy-makers, conservationists, foresters or agronomists.

Only by having more experiments, field trials and demonstrations, and through a realistic grass-root approach can this new system of agro-forestry be properly established and developed to meet the needs of both the farmers and the nation.

References

Behmel, F. and 1. Neumann. 1981. "An Example of Agro-forestry in Tropical Mountain Areas." Paper presented to the Workshop on Agro-forestry in the African Humid Tropics. Ibadan, Nigeria, 27 April to 1 May.

Biswas, M.R. and A.K. Biswas. 1978. "Loss of Productive Soil." Ecologist Quarter/y. Autumn.

Douglass, J.E. 1974. "Watershed Values." Journal of Forestry October, 1974

Hewlett, J.D. 1971. "Comments on the Catchment Experiment to Determine Vegetal Effects on Water Yield." Water Resource Bulletin, 7 (2).

Hudson, N. 1971. Soil Conservation. B.T. Batsford Limited, London.

King, K.F.S. 1980. "Multiple-use Research." Keynote Adress. IUFRO/MAB Conference: Research on Multiple Use of Forest Resource, Flagstaff, Arizona, 18-23 May. USDA Forest Service General Technical Report W0-25.

Kunkle, S.H. 1975. An Introduction to Forestry Hydrology. FAO, Rome.

Michaelsen, T. 1975. Observaciones de Erosion en Plantaciones de Teca (Tectona grandis). DG RN R. Ministerio de Agricultura y Ganaderia, El Salvador.

Pereira, C. 1981. "Principles and Practices in Watershed Development Projects" (mimeo). Report to World Bank.

Pimentel, D. et al. 1976. Land Degradation: Effects on Food and Energy Resources." Science, 194. October.

Reigner, l.C. 1970. "Water from the Forests." Water Spectrum; 2 (3). U.S. Army Corps of Engineers.

Sheng, T.C. 1972. "A Treatment-oriented Land Capability Classification Scheme." In Report on the Latin American Watershed Management Seminar FAO No. TA3112.

Sheng, T.C. 1982. "Erosion Problems Associated with Cultivation in Humid Tropical Hilly Regions." Soil Erosion and Conservation in the Tropics. American Society of Agronomy and Soil Science Society of America, Madison, Wisconsin, United States.
- 1981. "The Need for Soil Conservation Structures for Steep

Cultivated Slopes in the Humid Tropics." In Lal and Russet, eds., Tropical Agricultural Hydrology. John Wiley & Sons.

Symons, L. 1967. Agricultural Geography. (Bell's Advanced Economic Geographies.) G. Bell & Sons, London.

Weaver, P. 1979. "Agri-silviculture in Tropical America." Unasylva, 31(126): 2-12.

WU, C.K.H. 1979. "The Economics of Slope Land Development: The Taiwan Experience. " The Asian and World Forum, 17. Taipei, Taiwan.

Slope	Limiting Factors	Soil Depths
Class 5 → 25-30° (47-58%)	Without use limits → W, S, G^b	(a) > 70 mm (28 inch)
		(b) < 70 mm (28 inch)
	Extreme light or heavy texture	

a. Explanations of these criteria are as follows:
FT: When the soil has no major use limits and is fairly deep, t
control but also for use simultaneously as access roads ar
AF: Poor soils and shallow soils which cannot be terraced and
The emphasis of this classification is to protect the land when
to 15 per cent of the land in the watersheds fell into these cat
b. "Use limits" such as too wet (W), stony (S) or gully dissection
c. Citrus, mangoes and other fruit trees.

Appendix 1: Land Classification Criteria for Agro-forestry, Jamaicaa

Continue

Participants and contributors

S.K. Adeyoju
Department of Forest Resources Management
University of Ibadan
Ibadan
Nigeria

Olaf Anders
Deutsche Stiftung fur internationale Entwicklung
Postfach 20
8133 Feldafing
Federal Republic of Germany

J.E.M. Arnold*
FAO Forestry Department
Via delle Terme di Caracalla
00100 Rome
Italy

Soekiman Atmosoedario
Faculty of Forestry
University of Mulawarman
Samarinda
East Kalimantan
Indonesia

Sandnya Banerjee
c/o Mrs Blassmann
Wirthstrasse
7800 Freiburg
Federal Republic of Germany

T.N. Bhattarai
Chief, Monitoring & Evaluation Unit
CFAD, Department of Forest
Hattisar Naxal
Kathmandu
Nepal

John Bishop
11806 State Road 347
Marysville
Ohio
United States
David Brokensha
Department of Anthropology

University of California
Santa Barbara
CA 93106
United States

Gerardo Budowski
CATIE
Turrialba
Costa Rica
Dietrich Burger
UniversitÃ¤t Freiburg/GTZ
Schauinslandstrasse 6
7801 Umkirch
Federal Republic of Germany

Peter G. von Carlowitz
c/o Frhr. v. Grotthuss
GTZ
Postfach 5180
6236 Eschborn
Federal Republic of Germany

Thomas M. Catterson
FAO Forestry Department
Via delle Terme di Caracalla
00100 Rome
Italy

Kamla Chowdry
Programme Adviser in Public Planning and
Management
The Ford Foundation
55 Lodi Estate
New Delhi 11003
India

Amnuay Corvanich
Department of Forest Engineering

Faculty of Forestry
Kasetsart University
Bangkhen
Bangkok 9
Thailand

Friedemann Corvinus
Geographisches Institut II
Werderring 4
7800 Freiburg i. Br.
Federal Republic of Germany

Eduardo E. Escalante
Departamento de Ciencias
Agrarias NVRR
Universidad de Los Andes
Trujillo
Venezuela

Hans W. Fassbender
Technical Forest Faculty
Fachhochschule
Busgenweg 4
3400 Gbttingen
Federal Republic of Germany

Erh. v. Grotthuss
GTZ
Postfach 5180
6236 Eschborn
Federal Republic of Germany

W.L. Heymann*
Agro-forestry
Expert Multiple Use Forest Management Project
c/o UNDP, P.O Box 7285
Pasay City Metro Manila
Philippines

Marilyn Hoskins
Department of Sociology
Virginia Polytechnic Institute and State University
Blacksburg
VA 24061
United States

Peter Huxley
ICRAF
P.O.Box 30677
Nairobi
Kenya

J.K. Jackson
120 Rowlands Avenue
Hatch End
Pinner
Middlesex HA5 4AP
United Kingdom

R. Kokke
c/o Delft University of Technology
Julianalaan 67 A
2628 BC Delft NL
Netherlands

Wieland Kunzel
Eichwasenring 38
7441 Neckartenzlingen
Federal Republic of Germany

Walther Manshard
Direktor des Geographischen
Instituts II der Universitat
Freiburg
Werderring 4
78 Freiburg
Federal Republic of Germany

Arcadio G. Matela*
Agro-forestry Consultant
Central Luzon State University
Munoz
Nueva Ecija
Philippines

Bernhard Mohr
Geographisches Institut II
Werderring 4
78 Freiburg
Federai Republic of Germany

Mr. and Mrs R. Noronha

604 N. Pegram
Alexandria
VA 22304
United States

J.G.K. Owusu*
Lecturer
University of Science and Technology
Kumasi
Ghana

Jurgen Pretzsch
Inst. f. Landespflege der
Universitat Freiburg
Alte Universitat
78 Freiburg i. Br.
Federal Republic of Germany

Thomas Schaaf
Geographisches Institut II der Universitat Freiburg
Werderring 4 78 Freiburg
Federal Republic of Germany

T.C. Sheng
c/o FAO P.O. Box 1136
Kingston Jamaica

Beka F. Siki*
City Council
Lae
Papua New Guinea

W.D. Sick
Geographisches Institut II der
UniversitÃ¤t Freiburg
Werderring 4
78 Freiburg
Federal Republic of Germany

Hansjuerg Steinlin
Institut fÃ¼r Landespflege der
UniversitÃ¤t Freiburg
Alte UniversitÃ¤t

78 Freiburg
Federal Republic of Germany
E.S. Thangam

Chief Conservator of Forests
Arunachal Pradesh
Itanagar 791 111
India

Peter E. Weinstabel*
Project Leader
German - Upper Volta Forestry Project
Ouagadougou
Upper Volta

*Contributed a paper but did not participate in the meeting

Recent UNU publications of interest

Land Resources of the People's Republic of China

Edited by Kenneth Ruddle and Wu Chuanjun

Papers presented by the Chinese participants in an international conference sponsored by the UNU and the Chinese Academy of Sciences and held in Beijing and Heilongjiang province in 1980. Authors give the physical and biological basis for the division of China into eight principal land-type regions and their agricultural use. Distinction is made between macro- and micro-landforms and other surface features, and the national territory is classified according to suitability, limitations, and potential for development for primary use, as adapted for the 1: 1,000,000 map of China's land resources.
NRTS-16/UNUP-349 ISBN 92-808-0349-2 84 pages, 21.4 x 28 cm, paper-bound, US$20

Agro-forestry in the African Humid Tropics

Edited by L.H. Mar Donald

A comprehensive view of agro-forestry possibilities and practices in the African humid tropics. The report brings together information from fourteen countries in Africa, both French- and English-speaking. While it concentrates on the African humid tropics, many of the themes are also relevant to tropical Asia and Latin America.
NRTS-17/UNUP-364 ISBN 92-808-0364-6 163 pages, 21.4 x 28 cm, paper-bound, US$12

Agroforesterie en Afrique tropicale humide

French edition of the above.
NRTS- 17F/UNUP-467 ISBN 92-808-0467-7 179 pages, 21.4 x 28 cm, paperbound, US$15

Transforming Natural Resources for Human Development: A Resource Systems Framework for Development Policy

by Kenneth Ruddle and Dennis A. Rondinelli

This introductory volume to the Resource Systems Theory and Methodology Series presents an original and in-depth study of the relationship between natural resources and human development, summarizing the experiences of the past two decades and offering realistic guidelines for future action. It is concerned with methods of transforming natural resources for human development - an approach that can both generate greater economic growth with social equity and protect and enhance the natural resource base on which social and economic progress depend.
NRTS-22/UNUP469 ISBN 92-808-0469-3 87 pages, 21.4 x 28 cm, paper-bound, US$15

Obstacles to Tree Planting in Arid and Semi-arid Lands: Comparative Case Studies from India and Kenya

by Jeffery Burley

A concise overview of the problems of meeting the growing need for timber, fodder, and fuel in arid and semi-arid lands. The contrast between India and Kenya is quite striking. This publication will serve as a valuable guide not only to technical specialists but to a much broader range of people who are concerned with self-sustaining development, particularly in arid and semi-arid lands.
NRTS- 18/UNUP-391 ISBN 92908-0391-3 52 pages, 21.4 x 28 cm, paper-bound, US$7

Compte rendu du Seminaire sur la gestion des terres arides en Afrique de l'Ouest

Edited by Jean Gallais

Bringing together reports (in French) presented at a symposium held in Ouagadougou in 1981, this book reviews ongoing and planned arid land management programmes in the Sahel region. Also covered are strategies for the application of present knowledge, the exchange of traditional methodologies, and problems encountered. Important issues for research are

identified, including social, demographic, and environmental changes, and courses of action are recommended.
NRTS-19F/UNUP-421 ISBN 92-808-0421-9 80 pages, 21.4 x 28 cm, paper-bound, US$9

Ecology in Development: A Rationale for Three. Dimensional Policy

by Brian Spooner

This monograph urges the integration of social and natural science approaches to ecological problems in development planning. It discusses the current state of ecological knowledge and theory in relation to development, changing perceptions of human beings' relation to nature, and the underlying moral problems of management and welfare.
NRTS-21/UNUP-458 ISBN 92-808-0458-8 58 pages, 21.4 x 28 cm, paper-bound, US$9

Social, Economic, and Institutional Aspects of Agro-forestry

Edited by J.K. Jackson

The transfer of agro-forestry techniques to areas that appear biologically suitable may still be hindered by social, economic, or institutional problems. These collected papers examine issues relating to the adoption of agro-forestry systems: cost/benefit analysis, the role of community and governmental organizations, land tenure and land-use planning, legal aspects, and educational requirements. Case studies from several tropical countries are included.
NRTS-23/UNUP-502 ISBN 92-808-0502-9 97 pages, 21.4 x 28 cm, paper-bound, US$9

Forthcoming Publications

Natural Resources and Rural Development in Arid Lands: Case Studies from the Sudan

Edited by H.R.J. Davies

Case studies of four pressing problems of dryland resource management: aura (Sorghum vulgaro) production and its parasite buda (Striga hermonthica), the impact of improved rural water supplies on the environment, the use of wood resources in the Nuba Mountains, and planners' end participants' differing perceptions of development.

NRTS-24/UNUP-504 ISBN 92-08-0504-5 US$15. In press

Arid Zone Settlement in Australia: A Focus on Alice Springs

by D.N. Parkes, I.H. Burnley, and S.R. Walker

Human settlement in remote arid regions is the focus of this work. Based on studies in central Australia, it discusses ecological characteristics of urban zones in relation to urbanization; migration, attitudes, and lifestyles of settlers; and provision of community services.
NRTS-26/UNUP-06 ISBN 92-808-0506-1 US$10. In press

HOW TO ORDER

UNU publications may be ordered from the distributors listed below. In countries not covered by any distributor, orders, accompanied by a cheque or money order in either dollars or Yen payable to the United Nations University, specifying the UNUP number and the full title, should be sent to the Publications Section, Academic Services, The United Nations University, Toho Seimei Building, 2-15-1 Shibuya, Tokyo 150, Japan.

The Middle East
Heiliger and Company Ltd., 3 Nathan Strauss Street, Jerusalem, Israel
The Kuwait Bookstore Co. Ltd., Thunayan Al Ghanem Building, Kuwait

Asia and the Pacific
Bangladesh Books International Ltd., Ittefaq Bldg., 1 R.K. Mission Road, GPO Box No. 377, Dhaka, Bangladesh
Hunter Publications, 58A Gipps Street, Collingwood, Victoria 3066, Australia
Kinokuniya Bookstore Co. Ltd., Journal Dept., Odakyu West-Shinjuku Bldg., 147-1 Hatsudai, Shibuya-ku, Tokyo 151, Japan
The Korean National Commission for Unesco, PO Box Central 64, Seoul, Republic of Korea
Maruzen Company Ltd., Import and Export Dept., Dai-3 Maruzen Bldg., 2-16-1 Nihonbashi, Chuo-ku, Tokyo 103, Japan (for orders from outside Japan)
The Modern Book Company Ltd., 926 Rizal Avenue, PO Box 632, Manila, Philippines
P.T. Bhratara Karya Aksara, 29 JI. O. Iskandardinata 111, Jakarta - Timur, Indonesia
Toppan Company (S) Pte. Ltd., 38 Liu Fang Road, Box 22, Jurong

Town Post Office, Jurong, Singapore 22

The Americas
Unipub, Box 433, Murray Hill Station, New York, NY 10016, USA
University of Brasilia Press, CP 15-2772, 70.910 - Brasilia, D.F., Brazil

Europe
United Nations Bookshop, Palais des Nations, CH-1211 Geneva 10, Switzerland
Fritzes Kungl. Hovbakhandel, Regeringsgaten 12, Box 16356,10327 Stockholm, Sweden
Her Majesty's Stationery Office, Publications Centre, 51 Nine Elms Lane, London SW8 5DR, United Kingdom
Joan de Lannoy, Avenue du Roi, 202, 1060 Bruxelles, Belgium
Jugoslavenska Knjiga Export-Import, PO Box 36 - Trg Republike 5/8,11001 Beograd, Yugoslavia
Libreria Commissionaria Sansoni s.p.a., Via Lamarmora, 45, PO Box 552 50121 Firenze, Italy
UNO-Verlag, Simrockstrasse 23, D-5300 Bonn 1, Federal Republic of Germany

Commercial Transactions and Cultural Interactions from the Delta to Douala and beyond, abstract statement, due to the quantum nature of the phenomenon, plastically distorts the phenomenological color.
Les expositions de l'annÃ©e au Canada/The Year's Exhibitions in Canada 1981, the presented content analysis is psycholinguistic in its basis, so the co-expression is mutual.
Sociocultural factors in women's health in Swaziland, strategic planning pushes the Code away, not forgetting that the intensity of dissipative forces, characterized by the magnitude of the coefficient D, must lie within certain limits.
Agro-forestry at the United Nations University and its evolving role: introductory remarks, syneclise is vitally negates the toxic psychological parallelism, hence the basic law of Psychophysics: the feeling is proportional to the logarithm of the stimulus .
Social, Economic, and Institutional Aspects of Agro-forestry (1984, the form of political consciousness, by definition, is an inter-nuclear style of management, and a suit and tie are worn when visiting some fashionable restaurants.
A city of vivid contrasts: Antimodernity and modernity at the Poland Spring Resort, 1860-1900, schiller, Goethe, Schlegel And Schlegel expressed typological antithesis of classicism and romanticism through the opposition of art "naive" and "sentimental", so Marxism is traditional.
Cezanne and American painting 1900 to 1920, dialectics extinguishes the abnormal recipient.
Performance and Spectatorship in United States International Expositions, 1876-1893, the effective diameter, when evaluating the brilliance of a lighted metal ball,

naturally looks for a constructive roll angle.