*Agroforestry Systems 1: 299–311.*
*© 1983 Martinus Nijhoff/Dr W. Junk Publishers, The Hague. Printed in The Netherlands.*

# Economic considerations in agroforestry projects

J.E.M. ARNOLD

Forestry Department, Food and Agriculture Organization of the United Nations*

**Abstract.** Economic benefits that can accrue to the small farmer from incorporating trees in his farm system, and the economic constraints and costs he may face in doing so, are reviewed. Various economic considerations other than cash outlays and incomings, such as impact of risk, need to be taken into account. Issues are discussed that can arise in identifying, designing and implementing projects intended to help farmers to capture the economic potentials of agroforestry and to avoid or remove related economic impediments. Correct understanding of the factors which will affect the success of project interventions, valuation of the costs and benefits of trees as perceived by the farmer rather than by outsiders, distributional and equity issues, and identification of operational measures to ensure tangible short-term economic benefits are highlighted. The need for giving priority to research into the economic impacts of agroforestry practices on small farmer situations is stressed.

**Résumé.** Les bénéfices qui reviennent au petit fermier de par l'acquisition des arbres dans sa ferme, de même que les frais et contraintes économiques auxquels il doit faire face, ont été reconsidérés. Plusieurs problèmes économiques autres que dépenses et revenus, tel que le risque, doivent être pris en considération. Les questions émanant de l'identification, de l'étude et de la mise en oeuvre des projets qui aident le fermier à s'accaparer des ressources économiques de l'agro-foresterie et éviter ou même écarter les obstacles économiques, ont été discutées. Une juste interprétation des facteurs qui affecteront la réussite des projets a été mise en évidence, de même qu'une évaluation des frais et des bénéfices des arbres faite par le fermier lui-même plutôt que par des personnes de l'extérieur, les questions de répartition et de justice et aussi l'identification des mesures opérationelles pour assurer des bénéfices à court terme. L'accent a été mis sur la nécessité de donner priorité à la recherche en ce qui concerne les conséquences économiques des petits fermiers dans la pratique de l'agro-foresterie.

## Introduction

The wide range of different systems and practices encompassed by the term agroforestry have in common that they combine trees and agriculture within a single production system. The present paper is concerned primarily with certain aspects of agroforestry practices in small farmer production systems in the developing world. The purpose of the paper is to examine a number of economic issues that may arise in projects intended to support agroforestry

*An earlier version of parts of this paper was presented at the United Nations University Workshop on Agroforestry, Freiburg i. Br., 31 May–5 June 1982. The author wishes to express his appreciation for comments received on that draft of the paper.

practices in such production systems. Its focus is on the economic considerations affecting the farmer's decisions about the inclusion or removal of trees – what costs he faces which discourage or prevent him from incorporating trees, and what returns and other benefits could he obtain from them and from their presence on the land he farms.

Many of the costs and benefits to a poor farmer, living partly or wholly within a subsistence system, take forms other than cash outlays and incomings. For example, prominent among his implicit calculations is usually consideration of risk; the need, when living at the very margins of existence, to avoid any change which, though it might improve his situation if it functions as expected, could leave him even worse off than he is now if it does not. An assessment of the relevant economic considerations must therefore reflect these and other realities which shape the farmer's economic decisions, and not be confined simply to monetary assessments of cost and profitability.

Projects supporting agroforestry often introduce additional considerations. The interests of governments in encouraging agroforestry often include stabilising land use, diminishing environmental and resource damage, and developing 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, and therefore affect their economic decisions. The paper therefore also considers the implications of these external economic objectives and impacts upon the farmer.

A further issue that often arises in projects is the differential impact upon different segments and members of a community of programmes to introduce agroforestry activities. Some persons are likely to benefit more than others; some possibly being excluded altogether or even being disadvantaged by the changes. The equity and distributional aspects of agroforestry projects are therefore also reviewed.

The first part of the paper contains two sections which identify and review what are the economic benefits that can accrue from incorporating trees in small farmer systems, and what are the economic constraints and costs that may arise. The second part covers various issues that can arise in identifying, designing and implementing projects intended to help farmers to capture the economic potentials of agroforestry and to avoid or remove related economic impediments.

Many of the issues 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 agroforestry 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 farmer attitudes. Frequently basic institutions such as the community are breaking down, without any mechanism for replacing the services they provided having emerged. Growing pressures on the land have widely reached the point at which the perception of farmers towards their needs and their

abilities to meet them have drastically changed.

In order to reduce the subject to manageable proportions the present paper focusses rather narrowly on the immediate impacts of these broader changes on the viability and acceptability of agroforestry practices. However, the fact that what is being described is often but a symptom of much more fundamental pressures needs to be kept in mind.

## Economic benefits and incentives

Observation of the many traditional agricultural systems throughout the tropics in which trees occur has provided considerable evidence of the benefits that farmers apparently obtain from their presence [e.g. 5, 7, 15, 24]. These can be divided into a number of broad categories.

One widespread benefit from systems which feature trees during part of the production cycle is that of maintaining or restoring the productivity of the land. This underlies all systems of non-continuous cultivation which incorporate a period of tree fallow in the farming system. The soil enriching 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 [12].

Trees also perform this function in certain permanent cultivation systems, being intercropped, for example as alley crops or as shade trees, to raise nutrients to the surface layers of the soil through litter or green mulch, a function often combined with addition of nitrogen fixing tree species (often leguminosae). In other words, they provide a low cost alternative to fertilizers and soil conditioners.

Trees are also employed to maintain the productivity of the soil by protecting it from damage or destruction. Trees provide shade, shelter from wind, reduction in soil loss through row plantings to check runoff, etc.

A second widespread beneficial impact of trees of direct economic value to the farmer is in increasing the total output from the land by adding a tree crop to one or more lower layers of crops. A wide variety of such vertically structured multiple crop combinations are found in the tropics, in which the intercropped tree and crop species make supplementary or complementary use both of different layers of the soil and of the space exposed to sunlight above the surface.

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 permanent agroforestry systems, the home garden of the humid tropics, tree crops provide products

which complement the high calorie foodstuffs grown elsewhere in the farm system [24].

A third category of economic benefit is that of raising incomes by employing tree crops which provide higher returns from the land than alternative crops. Recent studies have shown, for example, that eucalypts grown on irrigated land in Gujarat, India, to produce poles and firewood for sale [9], and *Albizzia falcataria* grown on agricultural land in Mindanao, Philippines, for sale as pulpwood [11], produced higher returns to the farmers than the agricultural cash crops they displaced.

In some situations tree crops can increase incomes by using idle resources. Where systems of tree growing are used which are less labour intensive, and less tied to seasonal patterns, than production of alternative crops this can allow farm families to utilise more of their available land, where land is not a constraint, with their labour resources than would be possible only with annual crops. This, for example, was an important factor in bringing about the increase in farm net incomes through the pulpwood tree farmer programme in the Philippines cited immediately above.

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

Trees can also provide a capital reserve, to be harvested to provide income in an 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 as a fallow crop in parts of Sudan not only enriches the fallow, it also produces a marketable product, gum arabic, which is an important source of income to the farmers, and in addition fuelwood, fodder, fibre for rope-making, and other outputs of domestic value.

## Economic costs and constraints

The economic pressures militating against agroforestry systems have two overlapping effects. There are the pressures 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 retaining 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 the availability of the latter becomes scarcer the overriding need to produce food and income in the short term naturally takes precedence over these longer-term values.

This conclusion about the impact of growing pressure on the land base needs to be qualified. Some of the more widespread agroforestry systems – the home or tree gardens of Asia and the compound farms of Africa – were 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., 15]. 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 and stable. In Java cultivation of the tree gardens has adapted well to changing socio-economic conditions such as land and labour availability, marketing opportunities, etc. They are, however, part-systems of a total farm system, appropriate only when there is also land available within the system for production of staple food crops. Below a certain threshold of land ownership or income they are not appropriate [24].

This underlines a basic constraint in most agroforestry 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 because trees do not provide basic staple foods, and that they contribute nothing directly to the landless unless schemes can be devised to give them access to land.

Population growth also endangers existing agroforestry 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 village tree resource – though it is comprised mainly of fruit trees planted in the village areas – is being cut, principally to provide fuel, at a rate far in excess of its replacement. 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 larger populations require more housing in the village areas, so constraining the area available for the tree resource [6].

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. 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, for example, have described the process in an area in Kenya of

transformation of wood from an abundant, free good to a commodity of value, to be brought under control, protected and perpetuated [4].

Shifts in the values and costs of other uses of the land can also have impacts on trees and agroforestry practices. Market pressures 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 current forms of mechanization, creating impediments to the use of heavy 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. The principal economic constraint encountered by farmers in trying to introduce trees into their production system is usually stated to be competition for use of land with crops or pasture. Competition for land in this connection is often discussed in terms of either/or choices; if land is to be devoted to tree growing it will no longer be available for crop or pasture production. The reality in most agroforestry situations is evidently more complex and varied. As has been noted above, in many situations trees can be integrated with an agro-system in ways which result in supplementary or complementary increases in yields and/or returns. In many more situations crops or pasture can continue to be grown under trees even though the latter depress crop/pasture yields, because the resultant reductions in returns from the crops are more than offset by returns from the tree outputs.

The effects of competition from the tree overstorey on other components of the system is liable to vary with choice of species, number and spacing of trees, the management of the trees (e.g. crown pruning to reduce shade), and also with the status of the different growth factors – soil moisture, soil fertility, etc. – and the limiting effects these produce [18]. For example, it has been shown that shade reduced cocoa yields where soil fertility was high, but increased yields where it was low [2]. The subject of the impact of trees on intercrop yields is thus a complex one, on which there has as yet been very little research.

Among other economic constraints, one of the most important 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 product which will start producing returns at best a few years into the future. Hence the widespread preference in agroforestry for fruit trees and other tree species which yield outputs of value early in their production cycle, and for fast growing species, and for coppicing, pollarding and 'vertical pollarding' (branch harvesting).

The length of the production period imposes another economic constraint;

it increases the level of risk for those, such as tenant farmers or farmers practising 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. This is a fundamental constraint to agroforestry, which may in some situations need changes in basic legislation affecting control of the land to rectify.

The establishment, protection and tending of trees also entails costs to the farmer. It is important to recognise in what forms these costs have to be borne by a small farmer, and that they may weigh much more heavily in his economic calculations than in those of a forester or entreprenuer. Protection of trees against livestock or termites, for example, may require a cash outlay or expenditure of time greater than the farmer can afford. Avoidance of such costs is a characteristic likely to outweigh such conventional forestry choice criteria as yield and form in the farmer's calculations in selecting tree species [17].

Although, as has been pointed out earlier, agroforestry activities may sometimes enable economic use to be made of available labour, in other instances shortage of labour may prove to be a serious constraint. Some agroforestry operations are likely to compete with peak season labour demands. In off-season periods labour often migrates to work opportunities elsewhere. Some of the operations, such as the harvesting of the small-holder 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 [11].

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. During the transitional period to new systems when he still has to depend largely on his existing knowledge, skills and resources, the farmer is likely to find it difficult to abandon such traditional practices as burning and overgrazing which are inimical to tree growing [16], or of investing wealth in livestock, because alternative investment outlets have not yet been developed, to the point where livestock numbers build up to levels which result in destruction of the tree vegetation [13]. As was pointed out in the Introduction, some of the constraints to agroforestry thus stem from the much wider changes and disruptions that are occurring in the rural societies and economies of the developing world.

## Defining economic opportunities and problems

### *Analysing the situation*

The task of designing viable, acceptable, agroforestry projects rests very heavily on success in identifying the relevant factors in the local situation.

Some agroforestry programmes are very complex, being designed to provide alternatives to shifting cultivation which entail changes to the whole way of life of the people concerned. A whole range of investigatory measures will be needed in such cases, in order to understand what might be successfully achieved.

Even where the agroforestry 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 relevent factors [19]. Without an accurate understanding of such relationships, it is unlikely that it will be possible to define the interventions which will have the desired effect.

Thus, as has been indicated earlier, in one situation labour can prove to be the limiting factor constraining introduction of agroforestry activities, whereas in another situation agroforestry could be the means of raising returns to available, underemployed labour. The likelihood that the potential for raising farm returns through integration of trees can vary with the status of growth factors, such as soil moisture and nutrient status, reflects a further instance in which accurate knowledge of the local system, and of interactions within the system, is crucial to defining what role agroforestry activities should play in a given situation.

*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 the points of view of the village and of the forest service will generally lead to different assessments of the same project [20]. The objective of a forest service for 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 laid down 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 1975/76, 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 [3].

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 taungya as 'frankly exploitative in concept and operation' [21]. It is this 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. However, as has been frequently pointed out, most of the negative features could be partly or wholly rectified by changes in the way taungya is applied.

Similar divergences of interest and perspective arise frequently in projects designed to substitute shifting cultivation with 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, or the provision of incentives, amenities and services.

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 agroforestry systems. This concern has led to extensive debate over whether or not to pay for local labour inputs into agroforestry 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 the 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 protagnoists place on the socio-economic impacts which warrant mention. One is the conflict between indigenous and modern; the failure to recognise that for many rural people it is the variety of non-wood products from the indigenous forests which are of value – products which are not replicated in plantations or woodlots, the outputs from which often do not have value to the same people [10]. Projects which shift the use of forest land in the latter direction can not only severely disrupt 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.

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 can also arise within the community. An agroforestry project is unlikely to have a similar impact on all groups or individuals within a village. If the identification process is based on information from only, say, village leaders or heads of households, important needs and perspectives within the community can be, and often are, overlooked or incorrectly interpreted; leading to projects which neglect, or even disadvantage, for example, the landless, herders or women [10].

The problem, however, 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 has been widely observed, those with larger farms and greater resources are more likely to be able to benefit from innovation than small farmers.

The task becomes even more difficult and intractible if the objective is to use the agroforestry activity as a tool to achieve a positive distributional effect in favour of the poorer parts of the community. Noronha has drawn attention to the many divergencies and conflicts of interest within communities with the heterogeneity 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 and between different generations. There needs to be a tradition of communal action, and the presence of communal land, for communal tree solutions to be feasible, and labour available at the right time. To succeed, agroforestry 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 [14]. Recent work in Tanzania suggests similar conclusions [23].

The inequalities underlying these distributional and equity problems usually have deep institutional and political roots which could require far-reaching changes before such inequalities could be removed or ameliorated. 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 [1].

*Measures to support economic viability*

There remain a number of more narrowly operational measures in project design 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, or by using very fast growing wood or fibre species, or by incorporating complementary income-generating activities such as the mushrooms, kudzu fibre, etc., in village forest projects in Korea [8], or the honey, tasar silk, etc., produced by local people in forest areas in Java [22].

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 agroforestry 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 [11].

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 to the farmer of tree crops. In such situations it may be possible to reduce other elements of risk, for example by increasing the assurance that there will be market outlets and a profitable price for the new products, by ensuring correct choice of species and products, training and extension in the skills necessary to achieve marketable qualities, access to markets, etc.

## Conclusions

The introduction or strengthening of agroforestry practices through projects to support small farmers requires the usual prerequisites for any rural development activity – an appropriate and proven technical package, capability on the part of the farmers to absorb and use this, an extension training, credit and marketing system able to support the farmers in introducing and managing the new crop(s) and marketing the outputs, and assured supplies of seeds or planting stock and other needed inputs. At present much remains to be learned about what technical agroforestry packages might be appropriate in different situations. Research to date has concentrated on biological and physical aspects. As the ultimate test of appropriateness for the small farmer is the impact of agroforestry practice on his economic situation, research into the costs and benefits of agroforestry should also have high priority. Such research needs to reflect the actual on-farm situation of the small farmer, and assess costs and benefits in terms of values as perceived by the farmer.

## References


1. Agarwal, Bina (1980) The woodfuel problem and the diffusion of rural innovations. Report submitted to the U.K. Tropical Products Institute.
2. Alvim P de T (1977) Cacao. In: P de T Alvim and TT Kozlowsky (eds). Ecophysiology of tropical crops: 279–310. Academic Press, New York.
3. Ball JB (1977) Taungya in southern Nigeria. Project working document, FAO/UNDP Forest Development Project NIR/71/546–14, Ibadan, Nigeria.
4. Brokensha D and Riley B (1978) Forest, foraging, fences and fuel in a marginal area of Kenya, Social Process Research Institute, University of California, Santa Barbara. Paper for USAID Africa Bureau Firewood Workshop, Washington, D.C.
5. Budowski Gerardo (1982). 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: EG Hallsworth, (ed). Socio-economic effects and constraints in tropical forest management. John Wiley & Sons Ltd, London.
6. Douglas J (1981) Consumption and supply of wood and bamboo in Bangladesh. Project Working Document No. 2, FAO/UNDP Project BGD/78/010, Dacca, Bangladesh.
7. Food and Agriculture Organization of the United Nations (1978) Forestry for local community development. Forestry Paper No 7, Rome.
8. Gregersen HM (1982) Village forestry development in the Republic of Korea – a case study. Forestry for Local Community Development Programme series, Food and Agriculture Organization of the United Nations, Rome.
9. Gupta T (1979) Some financial and natural resource management aspects of commercial cultivation of irrigated eucalyptus in Gujarat, India. Indian Journal of Forestry 2(2) 1979.
10. Hoskins Marilyn W (1982) Benefits foregone as a major issue for FLCD success. Prepared for Community Forestry Workshop, Agency for International Development, Bureau of Science and Technology, Office of Multisectoral Development, Washington, DC, 12–14 July 1982.
11. Hyman Eric L, Seggay EU, Joves RS and Carpio RC. Tree farming from the viewpoint of the smallholder: an ex post evaluation of the PICOP project (draft manuscript).
12. King KFS (1968) Agri-silviculture (the taungya system). Bulletin No 1, Department of Forestry, University of Ibadan.
13. Maydell HJ von (1979) The development of agroforestry in the Sahelian zone of Africa. In: International cooperation in agroforestry, proceedings of an international conference. DSE/ICRAF.
14. 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.
15. Okigbo BN (1977) Neglected plants of horticultural and nutritional importance in traditional farming systems of tropical Africa, Acta Horticulturae 53, 1977.
16. Openshaw K and Moris J (1979) The socio-economics of agroforestry. In: International cooperation in agroforestry, proceedings of an international conference. DSE/ICRAF.
17. 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.
18. Raintree John B (1981) Bioeconomic considerations in the design of agroforestry intercropping systems. In: P. Huxley (ed) Plant research and agroforestry. Proceedings of consultative meeting, 8–15 April 1981. ICRAF, Nairobi.
19. Reddy AKN (1983) Rural fuelwood: significant relationships. In: Wood Fuel Surveys, Food and Agriculture Organization of the United Nations, Rome.
20. Romm Jeff (1980) Assessing the benefits and costs of social forestry projects. The Indian Forester 106(7), July 1980.
21. Seth SK (1981) Agroforestry in India and Sri Lanka. Forestry for Local Community Development Programme series, Food and Agriculture Organization of the United Nations, Rome.

22. Soekiman Atmosoedarjo and Banyard SG (1978) The prosperity approach to forestry community development in Java. Commonwealth Forestry Review 57(2) pp 89–96.
23. Skutsch M, Allen J, Barnes D and Ramsay W (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, D.C.
24. Wiersum K (1981) Tree gardening and taungya on Java – examples of agroforestry techniques in the humid tropics. In Viewpoints on agroforestry, Agricultural University, Wageningen, Netherlands.