Costs, Benefits, and Farmer Adoption of Agroforestry:
Lessons from Project Experience in Central America
and Caribbean

This note summarizes the results of a study of twenty-one agroforestry projects in six Central American and two
Caribbean countries (Figure 1) which analyzed the profitability of agroforestry for farmers as a crucial incentive to
adoption. The findings indicate that many agroforestry practices are profitable under a broad range of conditions
and are therefore likely to be widely applicable. Successful projects have worked with local communities, responding
to local needs and preferences and offering farmers a broad selection of species and systems from which to choose.
Demonstration plots and training of local people as paratechnicians have been low-cost and effective means of
identifying techniques and practices suited to the region.

Developing countries are facing major rural land use challenges, including deforestation, increasing scarcity of tree products and environmental degradation on fragile agricultural lands. One of the responses to these problems has been the promotion of “agroforestry.” Agroforestry, while it does not represent broadside reforestation in its traditional sense, does involve “on-farm tree establishment and management”, including managing natural regrowth, seeding, and planting of trees as border plantings, interplanted in agricultural crops, in woodlots, or in home gardens.

Public agencies, non-governmental organizations (NGOs) and international donors have supported agroforestry development efforts, and are considering further substantial investments. However, agroforestry activities have generally been poorly documented and project monitoring efforts have been weak or non-existent, or have addressed administrative concerns. Moreover, most analysis of agroforestry systems has dealt with their physical and biological aspects, whereas the economic contributions of agroforestry at the farm level have not been systematically assessed (Swinkels and Scherr, 1991). Indeed, producing trees for financial benefits has often been lacking as a primary project objective, which may have contributed to project failures. Nor has there been much comparative evaluation of extension approaches or their impact on farmer adoption of agroforestry.

Role in Farming System and Profitability

Agroforestry, in many ways, is comparable to other parts of the farming system. Its special characteristics include a large number of species, configurations, management intensities, longer gestation than most agricultural crops, and multipurpose usage of outputs.

Many agroforestry systems are profitable to farmers under a considerable range of economic conditions, and various types of (low-intensity) traditional agroforestry are indeed practiced in many areas. The tentative economic analyses in this study indicate that:

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Many agroforestry systems are profitable at real discount rates of up to 20 percent or higher; intercropping, if managed properly, tends to be superior to woodlots. Soil improving interventions can be profitable even with conservative assumptions of environmental effects. The performance of windbreaks tends to be poor, perhaps due to less than optimal design and local participation; and perennial intercrops diversify income, add value per unit of land, improve cash flow and cause only limited loss of the main product.

In their decision-making, farmers give great importance to the way an agroforestry system fits into the overall farm production system and the existing land, labor, and capital constraints. So, even more important for the farmer than the absolute profitability of agroforestry systems may be the returns relative to alternative options. The most profitable agroforestry systems sometimes have the most market risks. Some marginally profitable systems are widely used to meet specific household subsistence needs. Once those are met, there is an interest in market opportunities. The existence and/or development of markets is key for expansion.

**Extension Strategies**

The demonstration effect of fast-growing tree species and of benefits on demonstration plots has been a determining factor in the expansion of agroforestry activities. The demonstration effect can reduce the costs of extension and increase effectiveness.

Rather than just offering standard designs farmers would best be served if programs offered a fairly broad selection of species and systems from which to choose. This would allow farmers to select those most suitable to their household’s needs and resources.

Technical assistance is needed to facilitate adoption and to provide information about managing unfamiliar species and configurations. An endogenous process of agroforestry is clearly developing in parts of the region in response to economic incentives and subsistence needs. But this process is slow; its acceleration would require access to limited, but continuous, farm- or group-level technical assistance. Where new markets for products are being accessed or developed, extension services may also provide critical information and assistance in marketing.

Involving local people as paratechnicians is often a successful, low-cost approach to promoting technology. This helps to develop local human resources and the capacity to diffuse agroforestry beyond the project period, thereby making projects more sustainable.

Financial incentives and subsidies should be minimal. Agroforestry technologies promoted by extension should be financially profitable—and thus adoptable—for the farmer without subsidies. It is not clear from the case studies that financial incentives and subsidies, where provided, are in fact needed, at least for the size and duration found. There may be an argument for offering time-limited financial incentives for early adopters of unfamiliar technologies. Use of minimal in-kind, material inputs has been widely successful as incentives for farmers to experiment with and adopt agroforestry. The experiences with food-for-work incentives have generally been questionable.

**Agroforestry Adoption**

Local scarcity of wood products is a key factor in adopting non-traditional agroforestry. Scarcities differ significantly from country to country and from region to region within countries. Projects must begin by considering scarcity as well as the existence of local markets for products when locating agroforestry efforts.

New adoption of agroforestry systems is greatest for taungya, perennial intercrops, trees on contours, and tree lines. Results are mixed for alley cropping, home gardens, windbreaks, green manuring, dispersed trees in cropland, and tree-pasture systems. Farmers are willing to invest in rehabilitating their land where systems also...
produce products or income. Farmers prefer less-intensive systems. Participation by women is significant.

Due to management constraints and limited capacity to mobilize resources, smallholder adoption will and should be incremental and gradual. Poorer farmers may find agroforestry profitable, but their rate and scale of adoption is often constrained by limited land, labor, and capital resources and their need to ensure food security and reduce risks. Programs to promote rapid, large-scale adoption may put livelihood security of smallholders at risk, or bias adoption and benefits heavily towards higher income farmers. Continuous, small-scale adoption is a more appropriate objective for smallholder agroforestry programs. Preferred agroforestry systems offer short-term and intermittent benefits that permit farmers to self-finance investments in agroforestry.

Adoption patterns between small and large farms differ. For medium and large farms, fallow and extensive grazing are still important and intensive agroforestry systems may not yet be economically appropriate. In contrast, intensive systems may be more interesting for smallholders, but food security and risk issues play a more critical role than for large farmers.

**Social and Environmental Benefits**

There is little quantitative data available regarding the external (as distinguished from private) benefits provided by agroforestry systems. However, there is some information and anecdotal evidence that these projects are making social and environmental contributions which could justify further promotion for that purpose. Agroforestry systems are replacing less stable systems in watersheds, protecting the remaining forest resource by providing an alternative supply of tree products, protecting cities from the effects of airborne dust, and providing sources of employment and income generation for rural communities and thus helping to slow out-migration.

In order to get a better empirical handle on social and environmental impacts, much more data would have to be collected than is currently available. It is felt that more monitoring of projects is needed generally. In that connection, it is suggested that data be collected that allow social and environmental impact hypotheses to be tested.

**Institutional and Policy Implications**

There has recently been considerable regional and international debate about the types of policy reforms necessary to promote agroforestry as well as forestry. In general, issues such as macro- and intersectoral policy linkages, trade policies, institutional development, and conservation policy, are also relevant for Central America and the Caribbean. The findings of this study suggest that particular attention should be paid in this region to improving the institutional structure for tree product markets (e.g., information, monitoring, grading and standards; modification of regulations which restrict markets for farm-produced products; public support services for decentralized NGO extension/para-extension efforts; and incorporation of agroforestry into planning efforts.

Institutional responsibilities for agroforestry extension and support need to be defined. Because agroforestry falls between the ministries of forestry and agriculture, the institutional “home” for agroforestry activities has been weak. NGOs have taken a leading role. Semi-autonomous projects in close coordination with host government agencies represent a reasonably effective organizational structure.

One of the specific findings is that lack of land titles do not appear to be a significant constraint to agroforestry adoption in most areas. It is often argued that insecure property rights dissuade farmers from undertaking investments with long gestation periods, such as agroforestry, because they cannot be sure to reap the benefits of such investments. The important point is how secure farmers feel about their property rights with or without title. Often, even without an official title,
de facto property rights provide the farmer with enough security. In areas where tenure is insecure, titling is not necessarily the concern. Other uncertainties include unstable and rental markets, land invasions, civil unrest, and settlement in areas where private titles are illegal (in some conservation areas).

**Future Research**

It is hoped that the findings of the project analyses undertaken will be useful for project planners, policy makers and practitioners. Nevertheless, it would be desirable to be able to more precisely assess the effects of specific policies and extension approaches. For that purpose empirical studies would be needed with a large number of farmers with specific agroforestry practices sampled across a range of environments, farmsize, and market access. Also, given the dearth of information on farm and off-farm environmental effects, focused monitoring in that area would be particularly useful.

**References**
