

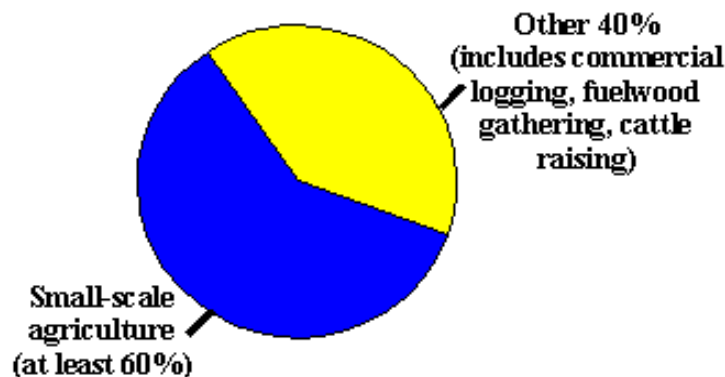
The Role of Agriculture in Saving the Rain Forest

by Stephen Vosti

Is Conversion of Forest to Agriculture the Problem?

Tropical forests are disappearing rapidly--with potentially high social costs in biodiversity loss and carbon emissions. But what does agriculture have to do with this? Consider the role of small farmers: they account for about two-thirds of rain forest destruction, by converting land to agriculture (Figure 1). Most of them are poor. They moved to forest margins to escape from poverty elsewhere, and they deforest in order to survive. Deforestation is not likely to slow until these people can earn a living and meet their food needs. And their numbers are growing, even where in-migration has slowed or stopped, as families reconstituted at the forest margin move through the life cycle. Agriculture to meet these food needs may lie behind much forest clearing--true. Still, only improvements in agriculture's performance as part of an opening up of alternatives for meeting basic welfare requirements can save the rain forest.

Figure 1--Tropical forest depletion by proximate cause



Source: N. Sharma, ed. *Managing the World's Forests* (Washington D.C.: World Bank, 1992).

Why Do Small Farmers Deforest?

Like rural households throughout the developing world, farm households in the forest margins strive to put enough food on the table for the next day, week, or month. In their struggle, farmers do not view natural resources as the most important asset, to be conserved at all costs, especially human costs. Although degradation is viewed as undesirable by the farmer and society as a whole, economic necessity predictably leads to land degradation.

In fact, when a farm household in the humid tropical forest margins slashes and burns as the initial

step in an agricultural cycle, it starts a clock ticking. During the first tick of the clock, annual crops are the crops of choice. Fertilized by forest residue, the nutrient-poor soils can support such crops, and recently arrived families, needing food (and without the resources to purchase food), plant them. Annual crop production, however, depletes soil, narrowing the crop choice of farm households at the next tick of the clock. At this point, they favor perennials, which in turn deplete the land (though at much slower rates). Finally, pasture and fallow--lower than the original forest in biomass and lowest in per hectare productivity for the farmer--become the only viable options. While farm households in other agroclimatic zones may see some narrowing of land-use options over time, in the humid tropical forest margins, it is the speed and certainty of this sequence (over several agricultural cycles) that is striking.

This does not mean that successful agricultural intensification is out of reach in these areas: with technical innovations, the range of agricultural choices open to the farmer could widen from current patterns, but few such innovations are currently available to resource-strapped farm households, and policies for promoting them are often lacking.

Well-known off-farm externalities, such as smoke and carbon dioxide emissions, which dissipate into the air above the farm, have no direct production consequences for the farmer; therefore, they do not play a major role in farm household decisionmaking. These environmental effects are important on a global basis, but from the farmer's perspective, private costs and benefits--the farmer's--matter most.

What Has Gone Wrong in the Past?

Because the poverty-stricken small farmer has a short time horizon for planning, incorporation of pro-environment choices can be difficult. This short-term perspective is not myopic, but rational: natural resource mining may be the only way, not the short-sighted way, to meet short-term goals. Policies that ignore this constraint generally fail.

For example, farmers must diversify income sources to survive, and improved infrastructure is key to such diversification. However, national and regional governments, often under pressure from the international community looking toward long-term environmental protection, make limited investments in all-weather transportation infrastructure. The problem for the small farmer is that even the investment in infrastructure needed to link existing communities is limited, which can make farmers more reliant on their natural resource base for survival.

The emphasis often placed on extracting forest products as an alternative livelihood activity is also illustrative, in that little is known as yet about the interdependence of different components of ecosystems; the impact of different techniques for extraction on these systems; the potential for marketing extracted products; and the consequences of, and scope for, expanding extractive activities.

Farmers often have insufficient knowledge to successfully implement sustainable agriculture. Populations transplanted from different agroecological environments do not carry with them the stock of knowledge about local conditions helpful in designing an environmentally compatible

farming system. Where indigenous knowledge about sustainable livelihood practices does exist, it often cannot support the higher population density that migration has brought.

Labor conditions must also be right: coffee production, desirable from an environmental and income viewpoint, requires high labor input and might be ruled out where labor is scarce. Cattle raising requires much less labor and might be chosen regardless of environmental consequences.

The bottom line: forest conversion will continue so long as it makes sense to rural households, given the incentives and constraints they face, regardless of the costs to society.

What Can Be Done?

If output generated from deforested plots and the value of natural products extracted from forests cannot be increased and sustained, the pressure on standing forests will remain. The "tools of the trade" for development planning--policies, technologies, and institutional arrangements--play a role in lifting constraints to implementation of environmentally sound practices. And they help encourage agricultural practices that use natural resources to boost livelihood security without using them up.

Policies need to change to take into account needs of current resident farmers, on land already deforested. This means helping them intensify their agriculture--through improved technology and access to well-integrated, reliable markets; credit; and roads that remain open in all seasons.

The generation and use of new, more sustainable agricultural technologies is absolutely critical. This requires focusing sights not on agricultural technologies that just meet growth goals or those that meet only sustainability goals, but on those that meet both growth and sustainability goals. The approach is controversial: there are fears that successes in agricultural intensification could attract new waves of migrants, and that introduction of nontraditional crops might disrupt the ecosystem in unforeseen ways. But clear definition and enforcement of property rights can help allay these concerns.

The third "tool" of development planning, the set of institutional arrangements (formal and informal, public and private) charged with generating, distributing, and implementing information and policies to achieve sustainability, growth, and poverty alleviation goals, has expanded dramatically over the past 15 years and now includes a vast array of governmental, nongovernmental, and hybrid forms. The forest margins have seen a dramatic proliferation of organizations--local, state, and international--but little is known about their relative sustainability or effectiveness, particularly cost-effectiveness, in meeting development goals.

Interregional Linkages

Forest margin areas generally do not enjoy a comparative advantage in the production of food staples: poor soils, severe pest problems, and intense, seasonal rainfall all keep yields low. These areas do, however, have a comparative advantage in agroforestry products, some types of livestock, and products extracted from primary or secondary forests. But poor infrastructure

leading to inefficient or even missing markets can lower and destabilize prices for nonfood items produced in the forest margins and raise and destabilize prices of the foods rural households purchase. These economic signals induce rural households to allocate time, money, and land to producing their own food, even though they do so inefficiently. To improve natural resource management in the forest margins, therefore, it is necessary to improve infrastructure and thereby promote the flow of nonfood and food products across regions.

Importance of Agriculture to Long-term Solutions

Looking toward 2020, three scenarios are possible. First, if all goes well, improvements in social and physical infrastructure will integrate forest margin areas into the economy. The combined agricultural productivity growth of the breadbasket and forest margin areas will be adequate to feed the larger population, lessening the pressure to convert forests to agricultural uses. In the second scenario, regional integration will only partially be successful. Productivity growth will be swift in the breadbasket areas, but it will languish in the forest margins, and deforestation will continue. Under the disastrous third scenario, regional integration will largely fail, agricultural growth will stagnate everywhere, and deforestation will accelerate. Which of these scenarios will prevail largely depends on agricultural intensification.

While agriculture is critical to the long-term solution of sustainable livelihood and food security in the humid tropics, it is only part of the story. To take pressure off land, nonagricultural sectors of rural economies must be strengthened in addition to improving agricultural productivity. In short, what is called for is a portfolio of agricultural, extractive, and nonagricultural activities that involve technological innovation designed for higher productivity of land and labor. These activities must translate into higher profitability for the farmer at lower cost to the environment and must be compatible with the constrained resource position of the small farmer.

Stephen Vosti is a research fellow in the Environment and Production Technology Division at the International Food Policy Research Institute.

"A 2020 Vision for Food, Agriculture, and the Environment" is an initiative of the International Food Policy Research Institute (IFPRI) to develop a shared vision and consensus for action on how to meet future world food needs while reducing poverty and protecting the environment. Through the 2020 Vision initiative, IFPRI is bringing together divergent schools of thought on these issues, generating research, and identifying recommendations. The *2020 Briefs* present information on various aspects of the issues.