Agricultural Policies and Tropical Forests

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Abstract: During the past decade, the degradation of the tropical forests has become a major topic in the worldwide discussion of the factors that threaten the long-term survival of the global ecological system. Undisputed in this context is the fact that agricultural production is among the major causes of the continuous reduction of the tree cover. As a consequence, efforts to stop deforestation have to accord high priority to agricultural policies that have played a prominent role in this outcome. This paper is concerned with these issues. It explains the role of agriculture in the process of deforestation in different regions and sub-regions and evaluates ways out of the dilemmas under different economic, social, and political conditions.

Introduction

The worldwide destruction and degradation of tropical forests is among the most important challenges to the global environment.[2] Over the last few years, it has been the topic of an increasing number of research projects, international conferences, and government hearings that have stressed its implications for climatic changes, genetic impoverishment, and long-term economic decline (Deutscher Bundestag, 1990; and Esser, 1989). Nevertheless, the question of how the process could in practice be stopped or at least slowed down has remained open. Undisputed in this context is the fact that agriculture is among the major causes of the continuous reduction of the tree cover. Yet the situation in most tropical countries is one of deep conflict between the short-term interests of those who farm the land (and often do not know of any acceptable alternatives to earn an income other than continually to take new land under cultivation) and the long-term objectives of the society that depends on forest conservation as an economic and ecological resource of survival. While the forests disappear at an ever faster rate, lack of foreign exchange in tropical countries severely restricts commercial imports of food and agricultural inputs and makes the production of agricultural export goods of particular relevance. These conditions decisively diminish the room for manoeuvre of agricultural policies that have played a prominent role in the process of forest destruction. Nevertheless, efforts to stop deforestation have to accord high priority to changes in the agricultural sector.[3] While the inevitable conflict produced by the competition between agricultural production and forest reserves for the same resources constitutes a common problem in all tropical regions, there are large inter-regional differences in the structure of interdependencies and in the economic, social, and ecological conditions.[4] Global suggestions, therefore, are far from being appropriate and cannot serve as a basis for promising solutions. The transfer of recommendations requires careful analysis of the respective clusters of circumstances, causes, and consequences. The present paper is concerned with these issues. It explains the role of agricultural policies in the process of deforestation in different regions and evaluates ways out of the dilemmas under different economic, social, and political conditions.

Tropical Africa

The conflicts in Africa between food production for subsistence survival and the preservation of the forest resource have become the most dramatic in the world. Over the last 40 years alone, Africa has lost about one quarter of its tree cover (World Resources Institute, 1989). The physical destruction of Africa's tropical forests is largely effected by shifting cultivators who act within a socioeconomic and policy framework that leaves them few other alternatives for survival than regularly to clear new forest plots for subsistence production. The forests are threatened by two kinds of settlers. The first is the traditional cultivators who are used to living in the forest areas and who apply farming systems developed over centuries on the basis of shifting cultivation. Such systems were sustainable as long as 1 km^2 was

supporting no more than 4–5 persons and as long as a patch of land could be left fallow for 10 years or more. Nowadays, however, due to growing populations and retreating forest area, a multitude of people are living on a given expanse in many parts of Africa. These traditional forest cultivators have been increasingly joined by a second group of subsistence peasants who, due to lack of land elsewhere, are moving into forests where they adopt a slash-and-burn style of agriculture that leaves even less scope for forest regeneration. Possessing little cultural adaption to forest environments, they "tend to advance upon the natural forest in waves: they operate as 'pioneer fronts' pushing even deeper into forest tracts, leaving behind them a mosaic of degraded croplands and brush growth where there is no prospect of a natural forest re-establishing itself, even in impoverished secondary form." (Myers, 1982, p. 75). The most seriously affected region is West Africa where the rate of deforestation on closed forests is six times higher than in Central Africa, which still holds vast reserves of largely untouched forests (Myers, 1989).

A number of causes have interacted to bring West Africa's rate of deforestation to the highest level of all tropical regions: high population growth, unfavourable land tenure systems, the persistence of slash-and-burn practices and land-intensive technologies, the catalytic role of timber harvesting in forest opening, lack of employment opportunities outside the agricultural sector, and the urgent need for foreign exchange. These conditions are most apparent in Côte d'Ivoire. What can be observed there has happened to a smaller or larger extent in most of the West African countries. The agricultural policy followed in Côte d'Ivoire demonstrates two strategies which in the African context have decisively paved the way for extensive deforestation by agricultural activities: first, the attempt to achieve economic development by following an export-led growth model, which for many years made Côte d'Ivoire an example of development for African countries; and second, the consequences of large-scale timber exploitation as a source of foreign exchange.

Similar developments as in Côte d'Ivoire have been observed in Liberia, where shifting cultivators penetrate with slash-and-burn practices into logged-over forests, following the many logging roads and hauling tracks, which since 1963 have made once remote areas easily accessible (Repetto, 1988); in Ghana, where over many decades the spread of shifting cultivation, which was promoted by large-scale logging operations, and the transformation of closed woodland into permanent tree crops (mainly cocoa) have destroyed nearly all the tree cover of the once forest-rich country (Sutlive *et al.*, 1981); and in other West African countries (Knerr, 1991).

A number of policy measures that might stop forest destruction in West Africa, and prevent other African regions from taking the same route, have been proposed. Prohibitions against forest clearing for purposes of shifting cultivation are hardly helpful in the socio-political context of most African states, as their practical enforcement poses unsurmountable difficulties, as has been exemplified in Liberia and elsewhere. Such efforts might even have reverse effects, as is demonstrated in Guinea-Bissau, where the prohibition of fire clearing caused farmers immediately to leave the area after setting it on fire, instead of controlling the fire as they did before. As a consequence, much more forest land is burned by the shifting cultivators than is intended (Knerr, 1989).

An often-proposed way to stop the deforestation is the establishment of private land ownership to increase the users' interest in higher land productivity and long-term fertility conservation, and prevent people from clearing ever new plots that are treated as a free resource. In practice, such policies have prompted a number of unwanted drawbacks. Adverse effects of land privatization leading to large-scale forest clearing—sometimes followed by the establishment of plantations of perennial crops—have been observed in a number of African countries where governments were apparently planning land registration and privatization of ownership. When, for example, in Côte d'Ivoire, a law was drafted shortly after independence saying that all cultivated land should be registered in favour of the actual cultivator, half the country's forests were immediately set on fire by slash-and-burn practices (Ley, 1982). Another often-observed reaction to increasing *de facto* privatization is the cultivation of permanent tree crops on large areas. This might be the cause of a significant share of Guinea-Bissau's recently established cashew plantations (Knerr, 1989).

The replacement of tribal groups' traditional control of usufruct rights by other forms of property rights, particularly by government ownership, is increasingly considered an additional threat to the forests. The perception grows that these communities had a greater interest in conserving their natural environment than private individuals or state governments. An evident example of this has occurred in Ghana, where the increasing assumption of state control over the forests made them even more vulnerable to the "tragedy of the commons" (Repetto, 1988).

The IMF and World Bank structural adjustment programmes, which West African countries apply in order to escape from their permanent debt crises, might still increase the pressure on forest land as (for lack of other realistic alternatives) they suggest the expansion of export crop production, implying the enlargement of cultivated land and the curtailment of subsidies for agricultural inputs (World Bank, 1989; Khan and Knight, 1985; and Zulu and Nsouli, 1985), causing a further drop in the price relation between land and capital inputs, which leads to more land-intensive production and decreasing land productivity.

In Central Africa, population densities are still low enough to allow a sustained agricultural use of the forest by shifting cultivators on a subsistence level. Pressure on land by farmers and spreading plantations is much lower than in other parts of the continent, and the forests are still hardly affected by timber exploitation. Zaire, in particular, still possesses vast areas of untapped but valuable forest resources (Kio, 1983). However, as the reserves of exportable timber in other regions of the world are fast being depleted, it is expected that the penetration by timber exploiters will very soon change this situation.

Large and growing cattle herds have caused important land degradation and deforestation in some tsetse-fly-free African regions such as Burundi by overgrazing and by urging crop cultivators to clear new forest land to meet their subsistence needs. The occupation of vast areas of land by such systems of extensive cattle breeding, which often contribute little to human nutrition, is often promoted by an agricultural policy that gives priority to the particular interests of the cattle herders for political or social reasons (Knerr, 1991)

Over recent decades, food production in almost all African countries has been increased mainly by enlargement of the cropped area, and to a much lesser degree by increasing land productivity. Productivity-enhancing technical progress has played a minor role. However, Africa's deforestation process can only be stopped if the productivity of the already-cultivated land increases and farmers are prevented from further land clearing. For example, fertilizer could be applied to replace soil nutrients, but this is not a practical solution in general. Fertilizers are too expensive for most African smallholders who often have no significant source of cash income, and mineral fertilizers are often not available due to weak infrastructure. The most important limitation in the long run seems to be the fact that a large share of the tropical soils can retain nutrients for only a short time; they are often leached immediately (Ellenberg, 1985). It sometimes helps to apply the fertilizer successively in very small portions and in organic form, but this is very labour-intensive and time-consuming and is therefore usually not accepted by peasant farmers.

The introduction of measures that could slow down or even reverse forest destruction would require a determined government policy that puts emphasis on long-term resource conservation. Yet governments, urged on by balance-of-payment problems and social unrest of the population, are used to deciding things on a day-to-day basis.

Lack of foreign exchange and high levels of indebtedness force African countries increasingly to provide the food needed for the growing population by domestic production. At the same time, it restricts the capacity to import inputs like fertilizers or pesticides that might contribute to higher land productivity. Moreover, the urgent need for foreign exchange implies an increasing necessity to produce exportable crops. Against this background, the present economic situation in most African countries leaves little hope for the preservation of the continent's forest reserves without major assistance from richer countries.

Putting all the arguments together, the only way to stop Africa's deforestation seems to be the introduction of sustainable agricultural production systems that both significantly increase land productivity and need a low level of external inputs. Technically mature systems, which imply a low level of external inputs, like agroforestry, have been developed and

are available (Adelhelm *et al.*, 1986; Haffner, 1982; and Dressler, 1984). They are, however, often not accepted by the peasants due to high input costs, particularly in the form of labour (Ellenberg, 1985).

Latin America

In Latin America, the forest area destroyed by expanding agriculture is estimated to be around 50,000 km^2 each year (Myers, 1982; and Denevan, 1978), or 0.43 percent of the region's forest area. The major cause of this deforestation has been land clearing for commercial purposes. Growing domestic and international demand for beef, combined with national policies that put a low price on forest land to be cleared, decisively promote the destruction of mostly virgin forests all over Latin America. Cattle ranching implies definite destruction because "the forest is cleared away entirely, and on a scale that will not allow for recolonization by adjacent forest if the pasture land is abandoned." (Myers, 1982, p. 751).

The country with the largest forest reserves in the world but at the same time that with the largest absolute annual loss of tree cover is Brazil. The Brazilian case has become the most well-known, as the on-going vast forest destruction has caused considerable controversy at the international level and brought Brazil under attack from ecological movements and political parties all over the world.

The foundation for large-scale destruction of Brazil's vast Amazon forests was laid in the mid-1960s when this area began to be considered a strategic resource for Brazil's economic growth and an unexploited resource for the country's well-being.

Massive fiscal incentives from the government channelled investment into the region, and the large-scale clearing of the moist forest became privately attractive due to public financial support (Binswanger, 1987). Among the tax- and credit-privileged Amazon development projects, the conversion of forest land into pastures for extensive beef production has been of major importance for many years.

Slash-and-burn practices of migrant farmers have their part in forest destruction in Brazil, too. Land clearing by settlers following the establishment of new infrastructure as well as government-initiated settlement schemes play an increasing role in this context.

Cattle ranching is a dominant factor in the forest destruction of other Latin American countries, namely in Mexico, Colombia, Peru, Bolivia, and a number of Central American states. It has increased tremendously over the last three decades due to growing domestic and foreign demand for beef. The ranching areas expand almost exclusively at the expense of primary forests and will soon be the most important cause of forest destruction in Latin America.

In the small Central American states, the particularly strong dependence on agricultural exports as the main earner of foreign exchange puts the most severe pressure on the forest reserves. Since 1950, the region's forest lands have declined by almost 40 percent (World Resources Institute, 1989). Forest destruction is closely related to the production and export of beef (Shane, 1986). Over the last two decades, cattle breeding for that purpose has significantly increased in all Central American countries, particularly in Costa Rica, Guatemala, and Honduras. By far the largest importer of beef from these countries is the USA.

Costa Rica is an example of the situation. As in other parts of Central America, export-oriented cattle rearing was among the first causes of extensive land clearing (Ellenberg, 1989). It was followed by sugar and tobacco cultivation, which led to locally intensive land use. Nevertheless, forest destruction remained comparatively moderate in the whole region until the early 19th century due to low population densities and a very weak transport infrastructure. Major deforestation in Costa Rica occurred with the first coffee boom around 1830. Over the past decade, cattle ranches have been the major cause of forest destruction in the country. In 1950, pastures accounted for one eighth of the country's land surface, by 1975 for one third, and by 1980 for around 40 percent (Myers, 1982). In the 1980s, the clearing rate for ranching purposes has been about 500 km^2 per year.

The rate of forest destruction in Costa Rica is still accelerating; today it is one of the fastest in the world. An area of about 600 km^2 is lost each year, and almost 90 percent of the cleared area is afterwards employed as pasture (Ellenberg, 1989). The pastures can be used only very extensively, and many are only used for 5–8 years. Almost all the wood decomposes near where it was cut. An insignificant share of the cut trees reaches the sawmills or gets used as fuelwood or for producing charcoal.

A similar pattern as that described for Costa Rica has more or less been followed by other Central American countries. Extensive beef production in the region is privately profitable because the ranch owners usually buy the forest land they intend to transform into pastures for next to nothing. A higher price for land converted into pasture should provide a powerful incentive for introducing production systems with a higher stockage per ha and more sustainable ranching on the same area. Technical possibilities for that purpose (e.g., the employment of improved animal breeds, improved pasture management, etc.) are readily available. However, as long as Latin America's large landowners receive important financial support from the government for clearing new areas of primary forest, and moreover receive forest land almost free, there is little incentive to maintain the soil stocking capacity but rather to practise "shifting ranching." The situation is sometimes complicated by the fact that the owners of large estates often have considerable political power.

In Latin America, the reason for fire clearing by land-hungry peasants does not appear to be an absolute shortage of land but rather the lack and delay of land reform, which is a major social and political issue in almost all of these countries.

Southeast Asia

Although the Southeast Asian countries have undergone a rapid expansion of their non-agricultural sectors over recent decades, one of their major problems has remained the satisfaction of the pronounced land hunger of their fast-growing population. In addition, the increase in food production can only partially keep pace with population growth. The industrial sector has not grown sufficiently to provide enough employment significantly to decrease the share of the population that depends on agricultural production for its livelihood. Therefore, "the need for more land remains a dominating political problem and the opening of new agricultural areas a main goal of regional and national development. This means conflicts in land use, especially an ever-growing pressure on forest reserves" (Uhlig, 1984, p. 8). The timber exploitation activities of settlers and shifting cultivators are considered the main immediate cause of most of the forest destruction. Southeast Asia is by far the most important region exporting tropical hardwood, with more than 80 percent of the internationally traded volume, almost exclusively from Malaysia and Indonesia (FAO, 1989; and Brünig, 1989). Although only few trees (often less than 20) are taken from a given area in the course of one logging operation, a number of surveys conducted in the region show that logging on average leaves one- to two-thirds of the remaining trees damaged beyond recovery (Myers, 1982), which makes the forests easy for migrant cultivators to clear. During the 1970s, farmers cleared at least 85,000 km^2 per year (Chandrasekharan, 1979), the greatest absolute loss of tree cover due to subsistence farming activities in any tropical region.

In the past, vast areas of forest land have been cleared for establishing plantations. Their products are still a major earner of foreign exchange for Southeast Asian countries, and therefore their future expansion seems more probable than any reduction.

Government-initiated settlement schemes are important in the region. They have gained priority in Indonesia, Malaysia, and Thailand and are held responsible for forest destruction in that they tend to proceed without sufficient financial and extension support.

Indonesia still possesses the region's largest reserves of closed forest. Around 150 million ha (about three quarters of the country's total land area) are still covered by woodland. This forest area must be considered as highly endangered, because it is reputed to be the world's most valuable reserve of tropical rain forest (Repetto, 1988), and the standard of living of the

fast-growing population is low. In fact, Indonesia's annual deforestation is by far the highest in the region, with an estimated 700,000 ha per year, but most of it is caused by land clearance for farming (Repetto, 1988).

In Malaysia, too, deforestation proceeds particularly fast. Although the country is the world's most important exporter of tropical timber, a much greater share of its vast annual loss of tree cover is lost through agricultural activities. During the 1980s, the country's forests retreated by an annual rate of 1.2 percent or 250,000 ha per year (FAO, 1981). The country's high rate of timber exploitation for export coincides with an unfavourable land rights system; any citizen can establish a personal right to use a piece of land just by clearing and farming it. Hence, forest lands that are opened up and partly degraded by timber exploitation are rapidly cleared from the remaining tree cover and taken into possession by settlers, a process which is promoted by widespread rural poverty (Segal, 1983).

In the Philippines, too, the exploitation of the forest reserves has constituted a most welcome source of foreign exchange for many years. Combined with logging operations, shifting cultivation has contributed decisively to the destruction of the country's tree cover. Swidden (shifting cultivation) systems, which over long centuries were sustainable, have recently led to extensive forest destruction following increasing population growth and shortening fallow periods that have led to decreasing soil fertility. The deforestation has wrought the most negative consequences on the agricultural production as it has left upper watersheds unprotected and destabilized river flows.

Traditional agroforestry systems that would allow a sustained cultivation of the same soil are in retreat in Southeast Asia. This is considered to be mainly a consequence of increasing land shortage and of the competition with production systems in which speculative crops such as coffee and cloves are more essential (Mary and Michon, 1987).

Conclusions

The extensive destruction and degradation of tropical forests is decisively promoted by agricultural policies in the form of producer incentives, massive public expenditures, and fiscal advantages for agricultural projects with questionable economic results. Governments that are in principle committed to observe the long-term interests of society, and hence to preserve the country's resources, give in to day-to-day social, economic, and political pressures. The forests are in this context treated as a free resource and serve as a short-term outlet for social and economic problems. If the presently prevailing trends continue, most tropical countries, have little prospect of possessing significant forest areas in the next century.

Although most governments of tropical countries seem to be aware of the threats posed by increasing forest destruction, they do little to modify those policies that contribute to accelerating the process. Major government parameters that could have a positive influence on forest conservation via developments in the agricultural sector are changes in tax and trade régimes, price incentives, and changes in land-tenure legislation. The policy changes needed to diminish the rates of deforestation and save forests at risk differ considerably from one region to another.

The African continent seems to be caught in a vicious circle of increasing population pressure, lack of non-agricultural employment opportunities, shortage of foreign exchange, and unclear land rights. This situation leaves little hope for saving the forests other than by financial support by richer nations, which might make sustainable agricultural production systems profitable to the individual farmer.

In the Latin American context, the removal of major fiscal advantages for large-scale forest clearing could contribute considerably to slowing down the rate of forest destruction. More complicated is the problem of forest destruction by shifting cultivators who use practices that they consider as necessary for their survival but which are extremely damaging to the forests. Here, appropriate agricultural reforms that would have to include measures of land redistribution seem necessary but might be very difficult to push through on a political level.

In Southeast Asia, the growth of non-agricultural sectors might take pressure off the forests as governments and individuals become less dependent on drawing on the forest land as a resource for creating income.

Policy changes require more than the availability of economic and technical solutions, however. Until now, the tropical forests have been used (or misused) for solving emerging political and social conflicts and for escaping from economic and fiscal pressure. Necessary changes in agricultural policies were postponed at the expense of the (seemingly free) forest reserves. How far the current processes of tropical forest destruction by agricultural activities are replaced by more sustainable methods of production on already-cultivated land is a political choice. Any move towards sustainable systems implies higher private costs that the individual farmer will not incur deliberately. An important step in introducing improved systems is to put a realistic implicit or explicit price on the forest land. Another step might be subsidies that make such systems privately profitable; depending on the situation, these would have to be paid by national or foreign donors who both have a vital interest in the long-term conservation of the tropical forests.

The mistaken policies of governments in tropical countries and the lack of financial support obviously contribute to tropical forest destruction, but the policies of governments in non-tropical industrialized countries, which hamper the development of non-agricultural branches in the economies of those countries, also play a role. Protectionism also plays an important part in this situation. These aspects should not be forgotten in the present context. If the process of deforestation cannot be stopped, irreversible damage to the environment that concerns the world at large will be the unavoidable consequence.

Notes

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[2]The tropical regions are defined as the regions with an average monthly temperature above 18° over the whole year. Land is defined as having a "forest cover" if it is "with trees whose crowns cover more than 20 percent of the area, and which are not used primarily for purposes other than forestry, whether reserved forest or not. This area includes also temporarily unstocked areas; i.e., forests in which trees have been temporarily removed by cutting or burning to such an extent that less than 20 percent of the area is covered by tree crowns. It excludes areas deforested by shifting cultivation and other wooded areas such as savannah and open woodland" (FAO, 1976, p. 4). This corresponds to the term "closed forest."

[3]Deforestation is defined as "the temporary or permanent removal of forest cover whether for agricultural or other purposes" (Grainger, 1983, p. 389). The difficulties of the practical methods that are applied for estimating deforestation and the problems associated with the reliability of the figures published about the rate of deforestation in various regions are described by Grainger (1983 and 1984).

[4]Agricultural land "comprises arable lands, orchards, vineyards, meadows, pasture, other grassland, agricultural land producing concurrent tree crops, and lands under shifting cultivation which are part of a recognized fallow rotation" (FAO, 1976, p. 4).

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Discussion Opening—*Kyrre Rickertsen* (Agricultural University of Norway)

Since World War II, deforestation has shifted from the temperate zone to the tropics. For example, during 1950–83, the area of forest and woodland fell by 38 percent in Central America and 24 percent in Africa. Simple projections indicate future deforestation that would reduce the tropical forest area by 10–20 percent by the year 2020.

Knerr's survey of the literature provides a detailed description of these large losses of tropical forests and some of the severe consequences of the losses. Furthermore, the negative effects on the tropical forests of agricultural policy as well as interactions of various government policies with agriculture are described. Finally, Knerr's conclusions appear to be reasonable, and she emphasizes that the solutions for better management of tropical forests may differ from region to region.

As a non-expert on tropical forestry, I will not go very much into the specific details in the paper but rather draw attention to two principles that I feel are not sufficiently emphasized.

First, I think it is uncertain that deforestation is always a negative form of land use. One sensible economic criterion for efficient forest management is to achieve the maximum net present value from all the forests' various possible uses over the long run. This implies that total benefits and total costs, discounted at an appropriate interest rate, for the various possible uses must be estimated. Then, the land should be devoted to the use—forest, agriculture, or other—that yields the greatest economic benefits.

Second, several of the benefits of the tropical forests are global. For example, the tropical forests contribute material for plant breeders and the pharmaceutical industry worldwide and may affect the global climate. If Third-World countries are expected to take these global benefits into consideration when they decide how to use their tropical forests, they should be compensated by the rest of the world when global considerations change the ranking of the alternative uses of the forests (e.g., "debt for nature" swaps).

[Other discussion of this paper and the author's reply appear on page 329.]