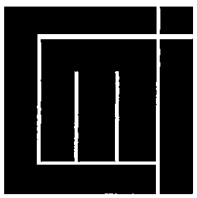
Debt and Deforestation: A Tenuous Link

Arild Angelsen and Richard Culas

WP 1996: 10



Working Paper
Chr. Michelsen Institute
Development Studies and Human Rights
Bergen Norway

ISSN 0804-3639

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Summary:

This paper examines the hypothesis that heavy foreign debt causes high rates of tropical deforestation. Empirical evidence indicates that no universally valid link exists between debt and deforestation — in either direction. After a brief discussion of the debt and deforestation problems, the paper outlines two different frameworks for understanding the (possible) links between debt and deforestation. It then considers various statistical analyses of the linkage, and review some more detailed country studies. The debt crisis lead up to the widespread adoption of structural adjustment programmes during the 1980s, and the paper also addresses the environmental impacts of the adjustment process.

Indexing terms:

Debt
Structural Adjustment
Deforestation
Environment

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1 Introduction[1]

A widely held view in the popular debate is that foreign debt of many developing countries causes or aggravates their environmental problems: heavy debt burden compels the countries to exploit the environment in order to service their debt. According to this line of reasoning debt relief may be beneficial in terms of both development, economic growth and environmental conservation. There is a simple and compelling logic to the debt-environmental degradation thesis. One needs, nevertheless, to critically examine the alleged relationship and ask for empirical evidence.

This paper focuses on tropical deforestation for two reasons: it is among the most serious environmental problems, and more data are available than for most other problems. Thus it allows for statistical testing of the relationship between debt and deforestation. The discussion will also be related to other environmental problems, such as desertification and soil erosion.

Hopefully, this paper may add some consistency and facts to a debate which at times is both polarized and politicized. Environmental groups typically argue that there is a strong link between debt and environmental degradation. They tend to see these problems as part of the terms on which developing countries participate in the international economic system, which also caused the debt problem in the first place. Some Western governments and multilateral organizations like the World Bank focus on domestic (national) failures, and seek to explain environmental degradation and the debt problem as symptoms of more deep-rooted problems of mismanagement of both the economy and the environment. Reed (1996: 1-2) uses the terms "externalists" and "internalists" on these positions.

Section 2 gives a brief background to the debt crisis, whereas section 3 discusses the causes of deforestation. A clear understanding of the mechanisms underlying deforestation is necessary in order to relate the debt crisis to the deforestation process. In section 4 we present two different frameworks for a discussion of the link between deforestation and debt, corresponding to the controversy between environmental groups and the World Bank just referred to. Then in section 5 we first explore the simple statistical relationship (correlation) between debt and deforestation, before examining some more detailed statistical analyses which have been done. We also summarize the conclusions from a WWF research programme on the environmental effects of structural adjustment programmes. Some policy issues related to the creation of global environmental markets are briefly discussed in section 6. We sum up and conclude in section 7.

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[1] An earlier version of this paper has been published in Newsletter no. 2, 1995 from the Study Group of North-South Issues ("Idegruppen om Nord/Sør"). We would like to thank Turid S. Bøe, Lual Deng, Odd-Helge Fjeldstad, Ottar Mæstad and Arne Tostensen for constructive comments to the paper. Responsibility for remaining errors is ours.

2 The debt crisis

Since the first oil price shock in 1973 there has been a general upward trend in the international debt burden of developing countries. This debt accumulation has for many countries not been sustainable, in the sense that they were not, and many are still not, in a position to service their debt. The unsustainability is a combination of two related but distinguishable factors: first, the size of the accumulated debt, and second, the poor economic performance of many developing countries over the past one to two decades.

In the early 1970s a world wide capital market emerged to which developing countries had ready access. The OPEC countries put a large share of their increased income in European and American banks, creating favourable terms for borrowers, including low interest rates and easy access. Western banks were not too concerned about how the money was spent and the creditworthiness of developing countries, i.e., their ability to repay.

Borrowing money is not bad if it is used in a way which promotes economic development and (thereby) increases the ability to repay the loan. South Korea and Indonesia are examples of countries with large foreign debts, but no debt crisis. They are, however, the exceptions rather than the rule. In most countries the capital inflow did not have the positive effects many expected. A large share was consumed as it was used to finance government budget deficit. Necessary reforms and economic adjustments were thus postponed. The capital inflow also caused an appreciation of the exchange rate (or less depreciation), thereby worsening the terms of trade and hampering the development of export industries.

Whereas it is easy to criticize this policy *ex post,* it should be understood in the light of the optimistic economic forecasts and the political climate two decades ago. For instance, the World Bank in 1980 projected a price index of primary products from developing countries to *increase* by 9.4 percent *annually* over the subsequent decade. The prices turned out to *decline* by 0.9 percent annually (Little *et al.,* 1993: 27). The policy should also be seen in relation to the hopes for high economic growth among Third World leaders, and a general belief that foreign capital and state directed investments were critical in promoting growth.

The second oil price chock in 1979-80 worsened the situation for most countries, and economic recession ensued in the global economy. High inflation rates in the US made the Federal Reserve tighten the money supply, which increased interest rates dramatically. The debt crisis became a global issue when Mexico in August 1982 announced that it could no longer service its debt. The fact that it was an oil *exporting* country that set in train the debt crisis illustrates the significance of domestic economic problems.

The debt crisis should be seen as the combined result of heavy borrowing in earlier periods, poor domestic economic performance, higher interest rates, and global economic recession following the second oil shock. The crisis was a result of both external (international) and internal (domestic) factors, but their relative importance still

remains a controversial issue. An immediate result of the Mexican moratorium was a reluctance on the part of major banks to continue lending. New bank lending to developing countries dropped from a peak of USD 44 billion in 1981 to 8 billion in 1984 and 4 billion in 1987 (Little *et al.*, 1993: 21).

As developing countries are no homogeneous group, some distinctions need to be made between sub-different groups of highly indebted countries. The main focus in the debate has been on middle-income countries, particularly those of Latin America, whose debts were mainly to commercial banks. Of the total Third World debt of around USD 950 billion in 1985, roughly 30 percent was owed by four countries in Latin America: Argentina, Brazil, Mexico and Venezuela. The low-income countries, mainly in Africa, commonly have even higher debt burden in relation to GNP (GDP), but smaller in absolute terms. Their debt was largely bi- and multilateral given on very concessional terms.

To developing countries the debt crisis is partly reflected in the fact that they have a large debt which they are obliged to repay, and partly that they are cut off from a substantial source of foreign currency on which they have become dependent. But probably most important, deep-rooted economic problems, which in part could explain the crisis, became even more visible and acute. Later experience has shown that the depth of these problems were underestimated initially.

The debt crisis spurred a number of economic reforms, most notably the structural adjustment programmes (SAP) which will be discussed further in section 4. Over the recent past repayments on foreign debt as percentage of exports have declined in most severely indebted countries, but the burden has grown for low-income countries (Jha, 1994). The debt crisis of developing countries is far from over. What has been achieved so far is a reduction of default on international debt, and therefore the threat to the international financial stability.

3 The causes of deforestation

Why worry?

During the 1980s, some 0.8 percent of the tropical forest area was lost annually (FAO, 1993). Several countries had a deforestation rate of more than 2 percent. The global concern has increased, both due to a generally higher environmental awareness and more accurate documentation of the costs of deforestation. At the global level, tropical deforestation accounts for about 25 percent of the heat trapping emissions (Houghton, 1993). One should note that, contrary to widespread myths, a forest in balance (no net growth) has no net absorption of carbon. Old growth (primary) forests do *not* "clean the air" for CO_2, but more carbon is released into the air when the biomass is reduced.

Another global concern is related to the loss of biological diversity. This richest ecosystem of the world is estimated to provide habitation for between 50 and 90 percent of all species on earth (WCED, 1987). In addition to global effects of deforestation is a number of adverse local effects: disturbance of hydrological cycles affecting ground and

surface water supply, increased runoff, flooding and soil erosion, changes in local and regional climates, loss of timber and other forest produce, etc.

What are the economic losses due to deforestation? Valuation of environmental services provided by rainforests is still inadequate, but the evidence so far gives some interesting conclusions, as pointed out in the overview by Pearce (1994). The value of non-timber forest products or minor forest products is what the name suggests -- minor. Similarly, the *pharmaceutical* values related to rainforest biodiversity is modest, only a few dollars per hectare. On the other hand, the carbon storage value may be several thousand dollars per hectare. The global community also seems to attach a high existence value to tropical forests.[2] The key conservation problem is that these are *global* benefits of preservation, and not benefits accruing to by the governments and the millions of farmers who take the resource-use decisions.

"The needy and the greedy"

A discussion of the causes of tropical deforestation should start by identifying the primary agents of deforestation: who cut the trees? The two main types of agents involved are what some have referred to as "the needy and the greedy". The needy are the farmers who convert forest to agricultural land, commonly practising the shifting cultivation (forest rotation) system. Agricultural expansion is often held responsible for about 50-60 percent of overall deforestation, even though this share may be exaggerated.[3] Other deforestation activities by the needy are pasture and fuelwood collection, estimates of their combined share are in the range of 15-20 percent (Johnson, 1991; World Bank, 1991).

The greedy refer to commercial agents involved in deforestation. These activities of these agents include timber logging, hydropower developments, plantations, and commercial agricultural estates. This development is undertaken by the state directly, or by private sector entrepreneurs enjoying favourable treatment by the state in terms of, for example, generous timber concessions (common in Southeast Asia), or favourable tax rules that stimulate "land development" (common in Brazil during the 1980s).[4] About 20 percent of the tropical deforestation is due to logging, but the indirect effect may be much higher due to the opening up of forest for migrating agriculturalists.

The two different sources of deforestation are by some government also classified as unplanned and planned deforestation. This may be misleading as it indicates that all planned deforestation is socially desirable, whereas the unplanned is not. The difference between the two types of agents may also not be as clear-cut as it appears at first. In both cases those who are in a position to use the forest find deforestation the most profitable alternative. The starting point for the analysis should be that the agents respond

[2] Existence value refers to the value people attach to an environmental resource in addition to its use value.

[3] Uncertain estimates and definitions of deforestation, and an interest by governments and others in "blaming the poor" for environmental problems, may lead to too high estimates of the share of deforestation attributed to expansion of traditional agriculture. See Angelsen (1995: section 2) for further discussion of this point.

[4] See Gillis and Repetto (1988)

rationally to the costs and benefits of different types of forest use. The next question is then what determines these costs and benefits, and how they can be influenced.

Market and policy failures

The key to understanding excessive tropical deforestation (and other environmental problems) is that it entails large costs that are *not* counted by those who take the decisions. The smallholder or commercial logger have little incentive to care about the climate effects of his or her actions. Such costs are labelled externalities in economic theory: they are external to the individual resource user (decision maker), but not to the (global) society. It is also referred to as a market failure, because an unregulated market economy will fail to produce an optimal outcome. It can also be viewed as a failure because there is no market for global environmental benefits, to which we will return in section 6.

The market failure could, *in principle*, be corrected by governments, for example, by taxing destructive uses of the forest, and subsidizing forest uses which are compatible with preservation of the protective functions of the forest. However, government policies often tend to further aggravate the problem. These are referred to as policy (government or intervention) failures, and is in this context loosely defined as government policies that worsen the environmental problems instead of remedying them. There are numerous examples of policy failures.[5] The government of Indonesia and some other Southeast Asian countries only capture about one third of the forest (resource) rent, defined as profit beyond the normal return on capital investments. It is commonly considered that the resource rent *should* belong to the society at large (the state or local communities). Thus, the failure by the state to capture the forest rent makes excessive logging more attractive. Lack of respect for traditional land rights, and other distorted institutional incentives which make property rights to forestland uncertain, could encourage short-term exploitation rather than long-term uses.

Poverty and population growth

Poverty, low income growth and high population growth may further increase the pressure on forest resources. There is, however, no unequivocal relationship between forest clearance and population growth. Among the factors influencing this relationship is the availability of alternative employment opportunities. If a country is able to create new jobs and keep unemployment low, one can reduce or avoid the pressure on natural resources created by high population growth. Malaysia provides an instructive example in this regard, and could be contrasted with neighbouring Philippines. Agricultural expansion in the Philippines is often caused by push-migration from the lowlands, due to lack of employment opportunities, and landlessness partly due to unequal land distribution (World Bank, 1989).

Poverty is often cited as both a cause and an effect of environmental degradation (WCED, 1987). It is unquestionable that environmental degradation in resource dependent economies will create or maintain poverty. The reverse causal link is more complex. Obviously, poverty may lead to short-term thinking and is characterized by

[5] Gillis and Repetto (1988) give the most comprehensive overview of such policies.

lack of resources to invest in long-term conservation of the natural resources. "Environmental thinking starts after breakfast", and with no breakfast there will not be much environmental thinking at all. However, case studies of environmental degradation among poor groups often show that the main factor behind reductions in the resource base have been resource exploitation by outsiders, either by state-sponsored projects, commercial interests, or other migrating groups.[6]

4 Linking deforestation to debt: two frameworks for discussion

On the basis of our discussion so far, a framework for analyzing the debt-deforestation relationship should seek to identify linkages between the debt problem and the decisions made by the *agents* of deforestation. How does high foreign debt directly or indirectly affect the costs and benefits of different land uses by different economic actors?

There is one formidable conceptual problem when discussing the effect of the debt crisis on deforestation (or other problems), that is, the problem of defining the counter-factual or reference alternative. What would have been the situation *without* the debt crisis? Maybe no structural adjustment programmes (SAP)? Maybe a different type of SAP? Perhaps the debt crisis just speeded up economic reforms that would have been necessary in any event? It is, of course, impossible to give a precise answer to these counter-factual questions.

As discussed in section 2, the debt crisis is to a large extent a symptom of a deeper economic crisis in many developing countries, but the debt crisis itself further aggravated the crisis. One reasonable hypothesis would be therefore that some structural adjustment efforts would have been required in any event, but not as comprehensive as became necessary after the debt crisis became manifest.

4.1 Debt as a cause of deforestation

We consider three different effects of the debt crisis which could be relevant to the rate of deforestation:

1. *Structural Adjustment Programmes (SAP):* The debt crisis was probably the most important factor, though not the only one, leading up to the widespread adoption of SAPs from the early 1980s onwards.
2. *Lower economic growth and reduced (opportunities for) poverty alleviation:* A high debt service ratio implies that resources are extracted out of the economy. Further, it is argued that debt works as a very high marginal tax on any income increases in the indebted country: a large share of the increase in income and export value will be used to repay the debt, hence the incentives to adjust and carry the costs (e.g., investments) will be low.

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[6] See for example Amirah and Johari (1995). For a further discussion of the poverty - environment linkage, see Broad (1994) and Reardon and Vosti (1995).

3. *Export orientation:* This has partly been included in SAP. But the simple fact that foreign debts must be paid back in foreign currency, which is obtained through export or aid, increased the pressure for more export earnings.

On the basis of the above, we have outlined in Figure 1 a number of possible links between debt and deforestation. Below we offer a more detailed discussion of each of the components.

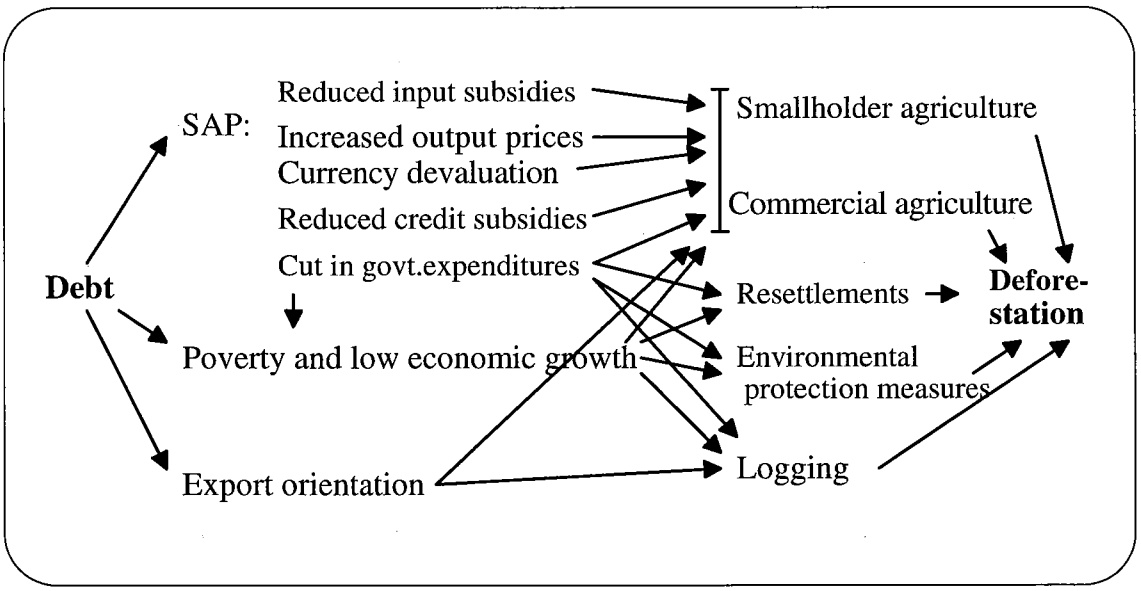

Figure 1: Possible causal links between debt and tropical deforestation.

4.1.1 Structural Adjustment Programmes (SAP)

The Structural Adjustment Programmes (SAP) were adopted by governments of many developing countries with the prime objectives of economic growth and debt servicing, through restructuring of the economy and improvement in internal and external balances. SAP is conveniently separated into two different (but interrelated) sets of policies: *stabilization*, emphasizing demand management, and *adjustment,* emphasazing supply- augmenting measures. In the initial (stabilization) stages of a programme the focus is on achieving a stable macroeconomic environment by reducing public budget deficit (internal balance) and achieving a realistic exchange rate through devaluation (external balance). A balanced government budget normally implies cutting public expenditures, together with other revenue enhancing measures like tax reforms.

The long-term and more difficult, but also most rewarding, part of SAP is the growth enhancing (adjustment) policies. The policy prescriptions towards this end include a number of microeconomic and institutional reforms, such as trade and price liberalization, removal of (agricultural) input subsidies, privatization of government banks, parastatals, marketing boards, etc. In practice, however, many of the policy reforms included in the SAP package were never implemented, particularly in Sub-Saharan countries.

The adjustment policies implemented in many developing countries in the 1980s were based on recommendations by -- or pressure from -- the international financial

institutions (the World Bank and the IMF). The SAP reforms were necessary in order to get access to multilateral assistance. Also from the mid 1980s bilateral development assistance was increasingly conditioned to the recipient country having an agreement with the IMF and the World Bank. Since aid is also being used to finance budget deficits, a country that did not accept SAP would have had an even higher budget deficit, or be forced to make even larger budget cuts.

The SAPs implemented during the 1980s did not specifically address the environmental impacts and conservation goals. There are several reasons for this omission (Reed, 1992). First, the environmental concern was not a priority for investments at that time. Environmental issues had not reached the top of the international political agenda. Second, the dominating view was -- and still is to some extent -- that the environmental problems were due to inappropriate macroeconomic and sectoral policies. By "getting the prices right", one could address both economic and environmental problems (win-win policies). Third, many feared that integrating environmental concerns would induce more budgetary outlays. And fourth, any negative environmental effects of SAP could better be addressed by mitigating measures tailored to specific problems.

This thinking still informs the design of about macroeconomic reforms and how possible negative social and environmental consequences should be tackled, but with some important modifications as discussed in section 4.2. We think this position is wrong for several reasons. First, social and environmental objectives are important and equally worthy of inclusion in economic policy formulation as is the objective of economic growth. Second, there is no guarantee that the mitigating measures will be taken, in particular, it has not been part of the standard SAP package. Experience shows indeed that this omission of complementary environmental policies has been the case (see section 5.3).

Third, and most important, given that SAP policies have environmental consequences, it is more efficient to consider these in the design of SAP. The standard practice of first to design SAP based primarily on more narrow objectives of economic growth, and then repair any environmental damage or take preventive action, is a more costly procedure. Such a practice is clearly based on weak theoretical foundations. Given that one has several objectives, it yields a better solution to use and design the policy measures with respect to all objectives simultaneously, rather than to use the measures in isolation to reach one objective at the time. Thus there are both cost-efficiency and political economy arguments in favour of integrating environmental goals in macroeconomic policy formulation.

Below we provide a discussion and some examples of how the various policy components of SAP may affect deforestation.

Removal of input subsidies and decontrol of output prices

Removal or reduction of subsidies on inputs, such as fertilizers and pesticides, implies higher prices to the farmers. This may partly or fully be compensated for by increases in output prices as a result of deregulation. To determine the net effect on output prices one

should also take into account the downward pressure resulting from removal of food subsidies.

What are the environmental effects of both higher input and output prices? First, the impact will depend on the changes in profitability (gross margin) for the different crops. Assuming that the profitability of agriculture in general increases, there are two conflicting hypotheses on what will be the effect on agricultural expansion, particularly in the form of cutting primary forest:

1. *Subsistence approach:* This model assumes that the main objective for farmers is to produce enough for their family's subsistence requirement, and that they do not give high priority to increased production and consumption beyond that level. Higher output prices and profitability in this model would reduce the need to expand agricultural land. SAP would therefore be good for forest conservation.
2. *Market approach:* According to this view, the agricultural expansion is determined by the relative profitability of farming at the agricultural frontier. Higher output prices therefore mean that more farmers will find it worthwhile to clear forest, both of those living there and through migration. SAP would in this case increase deforestation.[7]

Which approach is the correct one? Whereas the answer would be area specific, the subsistence approach may be relatively more relevant for short-term analysis, while the profit-maximizing approach gives a better description of the long-term effects (including the effects of migration). The subsistence approach would be relatively more relevant in poor economies. In most cases both effects are likely to be present, so the issue is which one predominates. Reed (1996: 329) finds that subsistence and commercial farmers acted quite differently to new price signals, and along lines suggested by the two above approaches, cf. section 5.3.

African countries that embraced structural adjustment programmes experienced significant increases in agricultural production. The growth rate more than doubled in reforming countries between 1980-1984 and 1985-1987, whereas it stagnated in non-reform countries (Deng and Oshikoya, 1991). The main factor behind the growth has been an expansion of agricultural land, rather than intensification on existing land. High rates of soil erosion, on average in the range of 0.5 - 1.5 of GNP, will seriously impede long-term agricultural productivity (World Bank, 1992).

SAP is also likely to influence the crop mixes. An example is given by Sankhayan (1995) in a study of the implications of changes in prices of agricultural products and inputs like fertilizers on cropping pattern and environmental variables in the Southern Highlands of Tanzania. Area and production of tobacco, an internationally traded crop, increased at the expense of maize and beans. This change is likely to have negative environmental effects by accelerating deforestation and soil erosion due to the increased wood requirements for tobacco curing and differences in the cultivation practices.

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[7] These two different approaches are discussed more closely in Angelsen (1995: section 3.1) and Angelsen (1996).

Finally, SAP will influence soil conservation practices. Ellis (1993) argues that higher fertilizer and pesticide prices may encourage manual soil conservation measures and integrated pest management practices by smallholders. Higher output prices have also been assumed to give more incentives to invest realized profits in natural resource conservation, and thereby the long-term productivity of the cultivated land. The latter is likely to reduce the pressure on marginal land and forest resources. It is also being argued that higher output prices results in higher land values, which again will encourage farmers to look at their land as a more valuable asset and pay more attention to soil conservation. This is, however, only one of several possible effects. Increased profitability may also encourage more intensive cultivation and thereby more erosion.

Currency devaluation

An overvalued exchange rate means that exports are discouraged and imports encouraged, and import (export) competing goods discouraged (encouraged). We may expect devaluation to induce a general switch from production for direct consumption or the domestic market, in favour of production for export or import substitution. We may also experience a general increase in the profitability of agriculture, which has already been discussed above.

The environmental effects depend on the structure of agricultural production. If tree crops rather than field crops are exported, a currency devaluation may be environmental advantageous. In the uplands of the Philippines, tree crops are exported whereas annual crops are produced for the domestic market. A devaluation would, therefore, have positive effects on the level of soil erosion as tree crops cultivation is stimulated (Coxhead and Jayasuriya, 1994). In some West African countries where groundnuts are exported, the effect of a currency devaluation would be the opposite.

Stabilization policies and removal of credit subsidies

Stabilization policies like inflation control could be attained by tightening the money supply. This is likely to result in higher real interest rates, both because inflation is reduced and *nominal* interest rates *may* increase. Inflation control *may* enable the smallholders to join the formal credit market since it becomes easier for them to save in form of cash. This is likely to stimulate investment in agricultural production (and conservation). SAP may, on the other hand, also induce cutbacks in credit subsidies and rural credit programmes.

An increased use of credit may result in intensification of land use, and therefore reduce pressure on forest resources based on the logic of the subsistence approach. However, cash poor smallholders are not likely to have access to formal credit markets, thus the main effect of SAP will be removal of (subsidized) credit through government channels. The result may be expansion on marginal lands and more forest clearing. This effect has been present in Northern Zambia, where traditional shifting cultivation (*chitmene*) has expanded after SAP was introduced in 1989 (Holden *et al.*, 1994; Culas, 1995).

Cut-backs in government expenditures

Adjustment efforts significantly reduced (growth in) current government expenditures in order to reduce budget deficits. Evidence from many countries suggests that social expenditures are hit more severely than others, and it is likely that environmental programmes have received similarly low priority. This appears, for example, to be the case in Mexico, where the environmental budget tends to be reduced more than overall expenditures (Reed, 1992). Further, a long-standing argument is that investments are cut more easily than current expenses when the budget balance has to be improved.

The magnitude of the effect of cuts in current spending on environmental protection is *not* expected to be very large, since in most countries there was not much to cut at all. Other and more fundamental forces are more critical for the development than scattered government interventions to protect the forests. Cuts in other government expenditures, such as health and education, may have long-term negative environmental effects. As an example, education for girls is among the investments with highest yields both with respect to environmental conservation and poverty reduction (World Bank, 1992).

Reduced public investment in, for example, rural infrastructure such as roads and public services may have reduced the pace of forestry and agriculture expansion by increasing the effective cost of opening up virgin forest lands (Reed, 1992; Hansen, 1989). This effect may be significant, as evidenced by the reduced "developments" in Amazonia in the 1980s due to Brazil's debt crisis. Generally, road construction is among the most indisputable and unambiguous factors in promoting deforestation.

Other policy reforms towards the agricultural sector include land reform, commonly in the form of introducing individual land titles. More secure land rights should improve the incentives for environmental conservation, since farmers themselves are more likely to harvest the fruits of conservation investments. The experience suggests, however, that land reforms in the form of individualized titling programmes are difficult to implement and often not successful (see, for example, Angelsen and Fjeldstad, 1995; Wachter, 1992). Moreover, in a situation where land rights are allocated based on forest clearing, increased land tenure security may actually increase deforestation as the "deforestation investment" becomes more secure (Angelsen, 1996).

4.1.2 Poverty and low economic growth

One of the fundamental issues of resource management in developing countries relates to widespread and persistent poverty. Although a large share of the urban population fails to meet its basic needs, absolute poverty is concentrated in the rural areas. Poverty is associated with low levels of income and consumption per capita, poor employment opportunities and a diminishing economic base as land becomes increasingly scarce and unproductive (Omara-Ojungu, 1992). Poverty makes short-term survival requirements dominate over long-term considerations. It will also reduce poor farmers' capacity to manage resources in a sustainable manner. Thus, farmers will tend to overuse the remaining land and move into forests and marginal lands.

A heavy debt burden can aggravate poverty and reduce the income of the poor by limiting the provision of various social services, and the development and maintenance of infrastructures. Moreover, the debt burden serves as a tax on the improved economic performance, as a large share of export earnings has to be used of for repayments. This lowers the incentives for undertaking reforms which can improve economic growth: the costs are borne fully by the country, whereas the benefits have to be shared with the foreign creditors.

The costs of the adjustment efforts following the debt crisis have to a large extent been shouldered by poor groups. According to Reed (1996: 331), "the dominant response of the poor to downward pressure on their living standards is to increase pressure on the environment and natural resources in order to survive".

Even though poverty was cited as a major explanatory factor for environmental degradation in the report of the Brundtland commission (WCED, 1987), the presumed linkage could be questioned or modified. First, poverty implies that people may lack the means to destroy the environment. Shifting cultivators may, for example, at some stage be able to afford buying a chainsaw, which makes it possible to cut much larger areas for cultivation. Second, some environmental problems are increasing with the level of production and consumption. This is typically true of problems related to the use of fossil fuels. For a relatively limited set of environmental problems, an inverted U-shaped relationship between pollution and income has been suggested, with a turning point of several thousand dollars of GNP/capita (an environmental Kuznets curve).[8] The improve growth performance of countries undertaking SAP has contributed to increased environmental pressure (Reed, 1996), making us face an unpleasant trade-off.

Another aspect related to economic growth is its impact on migration and resettlement programmes. Economic growth sometimes brings with it increasing income disparities, as some parts of the economy (usually the "modern" sectors) grow faster than others. Although total income levels are raised, internal income disparities may emerge to the detriment of the poor. Thus, the failure to resolve this distributional problem within the constraints of available resources, further encourage governments to pursue poverty alleviation policies that are harmful to the environment, such as opening fragile virgin land to cultivation (deforestation). The resettlement programmes in the two largest rainforest countries of the world, Brazil and Indonesia, are examples of a policy which -- at least partly -- can be explained in this way.

4.1.3 Export orientation - increased resource mining

There are different options available to a country in dealing with its debt problem, such as debt rescheduling, debt repudiation, increased borrowing, devaluation of the currency, restricting imports, and increasing exports. The actual number of options that are available to a country depends on its creditworthiness, export base and level of development (Kahn and McDonald, 1994).

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[8] See Steer (1992), Selden and Song (1994), and Grossman and Krueger (1995).

The export of agricultural commodities and timber are major sources of foreign exchange earnings for many developing countries, which indicates that this may be the most realistic option for increased export earnings, at least in the short run. With little or no concern for the future productivity of the forest and land resources, for example, through reinvestment, this development entails considerable risk for the depletion of the forest stock. The effect of an export orientation of agriculture has been discussed above.

Debt can also lead to myopic behaviour on the part of the government side, leading to deforestation rates that may not be optimal in the long run, but found necessary in the short-run to meet current needs. The imbalance created by overwhelming debt causes countries to adopt short-term policies, designed to meet the next payment of interest or principal, or to sustain positions in rescheduling negotiations.

On balance, one should note that there are also non-forest options to deal with the debt problem. One could construct an argument that if a country could maximize its income or net benefits through a particular rate of deforestation, then it would be optimal for it to pursue this deforestation rate *regardless* of the debt position (Kahn and McDonald, 1994).

A detailed study of the effects of SAP on deforestation in Bolivia demonstrates that the adjustment process lead to increased pressure on forests (Kaimowitz *et al.,* 1996). The pressure came largely from large scale commercial agriculture (soya beans) and the logging industry. SAP did not, however, contribute significantly to smallholder migration to the forest frontier.

4.2 Debt and deforestation have the same root cause

Whereas the World Bank (and IMF) did not include environmental goals in the SAP of the 1980s, the environmental attention has increased markedly during the 1990s. The revised World Bank view "represents a step away from neoliberalism and back towards the Bank's attitude of the 1960s" (Taylor, 1993: 869). The main slogan, as underscored in the 1992 World Development Report on development and the environment (World Bank, 1992), is *"win-win"*: improvements in environmental quality and economic growth can be achieved simultaneously, and partly by the same measures. Furthermore, environmental and economic problems are often explained by the same underlying causes. A prime example is subsidies of fossil fuels (including coal) which in the report is estimated to cost the developing countries (including Eastern Europe) about USD 230 billion annually (World Bank, 1992). Removing these would reduce the CO_2 emissions by about 10 percent. Increased emphasis on education and family planning are other areas which would be beneficial to both the environment and economic performance.

In this view, the debt and deforestation problems are due to general economic mismanagement, a misguided policy for rapid (and unsustainable) economic growth, public sector mismanagement, and elitist behaviour and corruption. These factors lead to levels of foreign borrowing that cannot be sustained, particularly when the borrowed resources are not invested productively. Similarly, environmental degradation is also the result of the drive for rapid growth, which lead to consumption of environmental

resources beyond sustainable levels. Thus they were both attempts to increase consumption beyond what the economy and environment could sustain (Shilling, 1992).

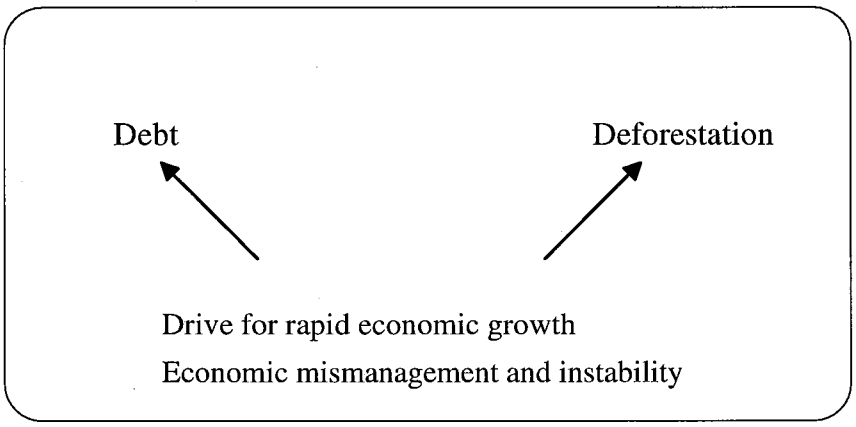

Figure 2: The root causes of indebtedness and deforestation

Before the adjustment reforms in the 1980s, many developing countries believed that public planning of investments coupled with substantial foreign capital inflows could be used to achieve sustained rapid economic growth and higher standard of living. The policies relied on state and state-owned enterprises, and included control of natural resources. But rather than acting to preserve these resources, they were often exploited by national (elite) interests and foreign owners to increase income rapidly. As a result, the economic policy distortions led to debt accumulation and natural resource depletion, but only rarely managed to deliver better standards of living for a majority of the population.

Both environmental conservation and investments to increase the economic performance are reflections of fundamental problems of the economic and political system: the problem of taking long-term considerations into account in today's decisions, and problems of coordination, for example, the correction of market failures. Thus, debt alleviation may confuse the causes and cures, and might lead to inequitable solutions, validate inappropriate behaviour, and create moral hazards (Shilling, 1992).

A dominating view within the World Bank is further that the debt and environmental crises are much more "an index of inability to cope systematically with multiple resource limitations than any evidence of strong causal links between them" (Shilling, 1992: 30). It recognizes that most developing countries need access to more technology and resources if they are to improve their economy and protect the environment, since most improvements in environmental policies require resources that are lacking in many of these countries, and their debts represent claims on these scarce resources. As such, reducing the debt burden could help achieving environmental objectives as well as encourage economic growth by giving these countries access to these scarce resources. Thus, debt is not a major cause of environmental degradation, but reducing debt may help improve the environment.

The win-win strategies should clearly be pursued aggressively, as they remove the conventional conflict between what is good for the environment and what is good for the economy. But why are such strategies not implemented on a larger scale? A simple and powerful explanation is that there are not only winners. Even though the *overall* impacts on the economy and on the environment may be positive, there will almost inevitably be both winners and losers, and the latter group may have sufficient power to block reforms. Behind proposals of a "win-win" nature at the aggregate level are hidden several lower-level "win-lose" situations.

The approach may also be criticized for its neglect of international factors contributing to the environmental and debt crisis. It also tends to overlook that even though a universally valid causal link between debt (and SAP) and deforestation and other environmental problems is hard to establish, there may be strong links for a number of countries, which should not be disregarded, for example, in the design of SAP.

5 What do empirical studies show?

The main lesson from the above discussion is that it is impossible to draw firm theoretically based conclusions about the relationship between debt and deforestation. There are a number of *possible* mechanisms linking high debt to high rates of deforestation, and similarly a number of arguments pointing in the direction of a negative correlation. We now turn to the empirical evidence. What do the data show?

5.1 The simple statistical relationship

A first step in the analysis is to seek to establish a simple correlation between debt and deforestation. Figure 3 presents cross-national data for the annual deforestation rates for the period 1981-1990, and the debt service in percentage of total export in 1980. We want to depict the impact of debt on deforestation, thus the debt at the beginning of the period has been chosen for most part of our analysis. We shall also make references to analyses using 1985 and 1990 data. The variable debt service ratio is meant to be a proxy for the debt burden, although other measures are also used.[9] Deforestation rates are average annual deforestation in the period 1981-1990, in percent of forest cover in 1980. Also other measures -- in our view more questionable -- have been used, such as deforestation as percent of population or of GNP. Some studies also use forest cover as the dependent variable, of which the appropriateness should be seriously questioned (Kummer and Sham, 1994).

Deforestation estimates vary considerably.[10] We have used the assessments made by FAO (1993), which is considered the most reliable but still questionable. The data are generally based on national forest inventories, which varies considerably in definitions of deforestation, quality and time periods covered. To estimate deforestation rates (1981-90) a model with populations density as the only explanatory variable has been

[9] For example, debt service ratio as percentage of gross national product (GNP), or total debt as percentage of export or GNP.

[10] See Grainiger (1993) for a critical review.

used. Thus the estimates in many cases reflect population growth more than actual deforestation.

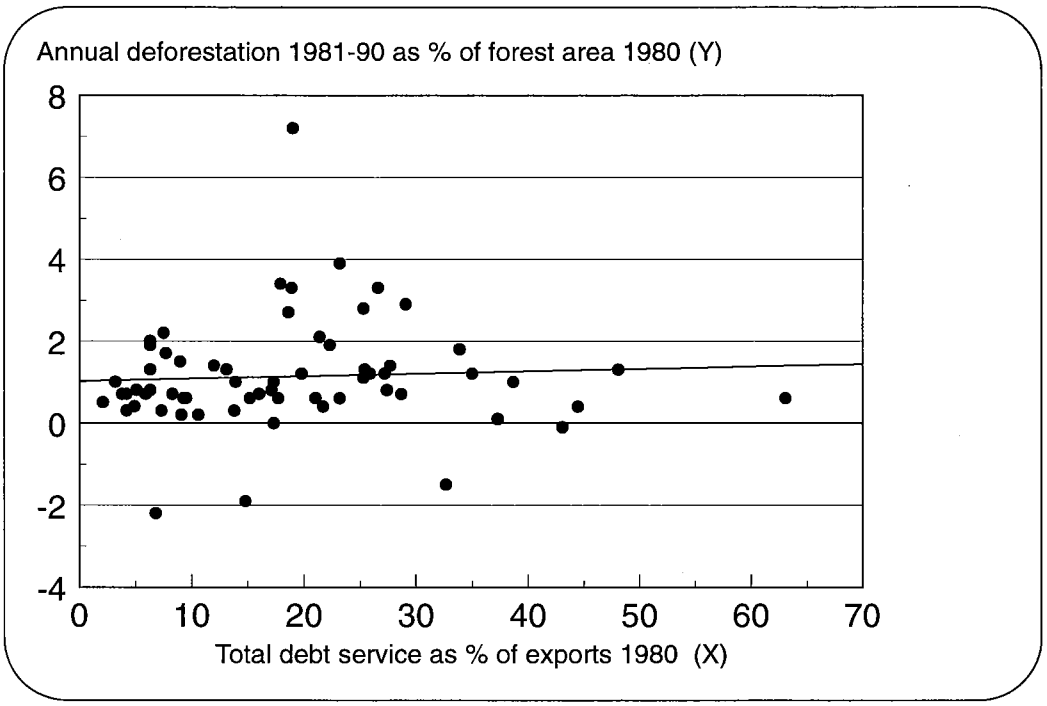

Figure 3: The relationship between deforestation and debt service ratio.
Sources: World Bank (1995); deforestation figures are based on FAO (1993).

Figure 3 reveals *no systematic correlation between debt and deforestation.* The regression line plotted indicates a very small and insignificant positive relationship. The R-square, that is the share of the variation in deforestation that can be explained by the variation in debt, is only 0.3 percent. Using the debt/export ratio for 1985 instead of 1980 yields essentially the same picture. Thus, our first tentative conclusion is that debt and deforestation are not correlated.

Dividing the sample into low and middle income countries (1980) reveals a positive and significant correlation for low income countries, with an R-square of 13 percent. For middle income countries, there is a weak and insignificant negative correlation. Using debt data for 1985 gives no significant difference between low and middle income countries, for both there is an insignificant, positive correlation.

A geographical breakdown gives no clear picture for Africa (a very weak negative correlation), a slight negative correlation for Latin America, whereas it is significantly positive for Asia. Using the debt burden in 1985 instead of 1980 changes the picture: A weak and insignificant correlation for Africa, a positive correlation for Latin America, whereas the positive significant correlation for Asia (using 1980 data) has disappeared. When using 1990 data, we find that the correlation for Asia has switched to a negative one, whereas it is insignificant for the two other regions (and overall).

In summary, the breakdown neither by region nor income level yielded any more firm conclusions regarding the relationship between debt and deforestation. The correlation is generally weak, and the size and sign are very sensitive to the year used for the debt burden.

In Table 1 we have classified the tropical rainforest countries according to their debt and deforestation rates. Only one country (Equador) had both high rates of deforestation (above 1.5 percent) and a high debt service ratio in 1980 (above 30 percent). Note that Brazil, the largest rainforest country in the world and the country with the largest deforestation in absolute terms, has relatively low *rates* of deforestation in the 1980s (0.6 percent). Generally, the high deforestation countries are over-represented in the medium debt group (67 percent). See also the appendix for a complete listing of all countries and their deforestation and debt ratios.

Debt service ratio, 1980	**Annual deforestation 1981- 90 as % of forest area 1980**			
	Low (< 0.5)	**Medium (0.5 - 1.5)**	**High (> 1.5)**	**Total**
Low (< 15)	8 Ethiopia, Rwanda, Central African Rep., Congo, Botswana, Papua New Guinea, Trinidad & Tobago, Mauritius	15 Burundi, Chad, Nepal, Mali, Burkina Faso, India, Nigeria, Togo, Gambia, Benin, Ghana, Zimbabwe, Sri Lanka, Indonesia, Colombia	4 Guatemala, El Salvador, Panama, Malaysia	27
Medium (15-30)	4 Sierra Leone, Niger, Mauritania, Tunisia	12 Tanzania, Uganda, Malawi, Madagascar, Kenya, Zambia, Guinea, Senegal, Gabon, Myanmar, Algeria, Venezuela	10 Bangladesh, Pakistan, Thailand, Nicaragua, Honduras, Philippines, Jamaica, Paraguay, Costa Rica, Dominican Republic	26
High (> 30)	4 Peru, Chile, Morocco, Argentina	4 Brazil, Mexico, Côte d'Ivoire, Bolivia	1 Ecuador	9
Total	16	31	15	62

Table 1: Classification of countries according to deforestation rates and debt service ratios.

Sources: World Bank (1995); deforestation figures are based on FAO (1993).

5.2 Econometric studies

Whereas we in section 5.1 considered only debt as a possible explanatory factor of deforestation, econometric studies (regression analysis) try to determine the explanatory power of several variables. It is possible, in fact, that debt may be a significant factor in such an analysis, even though we did not find any general correlation in the simple analysis above.

In view of the prominent position the issue has had in the international debate, surprisingly few studies of deforestation have been undertaken where debt is included as an explanatory factor. Brown and Pearce (1994), which is the most comprehensive collection of statistical studies of deforestation, report only four studies. In summary, two of them find that high levels of debt contribute to high rates of deforestation, one finds the opposite effect, whereas the fourth finds no significant effect.

There are, however, methodological problems connected with all of them, which we shall examine below. Furthermore, there are some general problems related to cross-country regression analysis (see Cappelen and Fagerberg, 1995). First, to get meaningful results the explanatory variables must affect deforestation in roughly the same way in all countries. The discussion in section 4 indicated that this is a strict assumption. Second, due to lack of data there will certainly be a number of omitted relevant variables. If these variables are correlated with some of the variables included, the estimates will be biased, and we will not know the "true" explanatory power of the included variables. Third, important country-specific factors are difficult to capture in such analysis. "General statements about the causes of tropical deforestation which are based on cross-national statistical tests are of little value since that they virtually nothing to say about deforestation within individual countries" (Kummer and Sham, 1994: 158)

A study by Kahn and McDonald (1994, 1995) on Third World debt and tropical deforestation develops a behavioural model which suggests that debt can lead to myopic behaviour, leading to deforestation rates that may not be optimal in the long run. Their regression analysis is based on country-by-country data for debt, deforestation, and other variables such as labour force, government spending and investment. They conclude that debt is significantly positively correlated with deforestation under a wide variety of assumptions and specifications. The measures of deforestation used are deforestation in hectares per million people, or per million real GNP in US dollar terms, which appear to be strange measures. Both debt and deforestation figures are averages for the period 1981-1985, thus there is little allowance for lag effects.

Shafik (1994) looks at the deforestation over a much longer time span (1961-1986). He concludes that there is no statistically significant relationship between indebtedness and deforestation. Indeed, his main conclusion is that "there are very few macroeconomic causes of deforestation at the aggregate level. Many of the variables often cited in the literature - poverty, trade and indebtedness - are consistently insignificant" (page 95). He finds two significant macro variables which contribute to deforestation: a high level of investment goes in tandem with high rates of deforestation. The second factor is political and civil liberties, but the correlation is not what we all would hope for:

democratic societies have more deforestation! This may be an example of how statistical correlation may be something very different from causal explanation. Nevertheless, theories and potential causal links should be validated by statistical testing.

Capistrano (1994) appears to be the most thorough study on the debt-deforestation link. Unfortunately she limits the analysis to industrially logged forest. She divides the analysis into four different sub-periods between 1967 and 1985, which makes good sense. She finds that debt is a significant explanatory variable only for the period 1972-1975, and then the effect is negative: less logging occurred in the early 1970s in the most indebted countries. One possible explanation is that high debt reduced the investments in logging activities.

These results suggest that the link between debt and deforestation rates is tenuous. Which factors at the aggregate level could then explain deforestation? In a summary of some 20 studies in Brown and Pearce (1994), there are few unambiguous conclusions. An exception is population *density*, which increases deforestation, whereas the effect of population *growth* is indefinite.[11] Given that most deforestation figures, as in FAO (1993), are in the first place estimates based on population density, this should hardly be surprising. What is surprising, though, is the uncritical conclusions commonly made about the effect of population growth on deforestation, a critique well elaborated in Kummer and Sham (1994). Finally, even a statistical correlation between forest cover and population density (see Palo, 1994, for the evidence), does not necessarily suggest a causal relationship. It may simply be a reflection of the fact that few people live in forests.

5.3 Country studies - the WWF research programme

Given the problems associated with econometric studies of the debt-deforestation link, detailed country studies could provide better insight into the mechanisms at work. Among the most comprehensive studies in this field appears to be the research programme organized by the World Wide Fund for Nature (WWF) on the linkages between structural adjustment and the environment. Even though some may expect the work sponsored by an environmental NGO to have certain biases, the two main books published by the programme provide a pragmatic and agnostic approach, and the conclusions are well balanced. This contrasts, for example, a related World Bank study on the impact of economywide policies on the environment, summarized in Munasinghe and Cruz (1995). This report claims that "getting the prices right"-policies under SAP "generally will contribute to both economic and environmental gains" (page ix). Neither the WWF research programme nor other studies support such a generally optimistic conclusion.

The WWF research is documented in Reed (1992), which includes three country studies (Côte d'Ivoire, Mexico and Thailand), and Reed (1996), which summarizes the experience of nine countries (Cameroon, Mali, Tanzania, Zambia, El Salvador, Jamaica, Venezuela, Pakistan and Vietnam). A major conclusion is that the environmental impacts of the adjustments are mixed, and one cannot in general claim that the SAP has

[11] Obviously, high population growth leads to higher population density over time.

made the environmental conditions better or worse. Thus there is no support to simplistic views of a definite linkage in either direction. Beyond this general statement, the studies report an number of interesting findings which have not yet been fully appreciated in the international debate. Some of these are summarized below.

The SAP has been successful in promoting economic growth, and the improvement in basic macroeconomic indicators are better for the countries that undertook structural adjustment than for those that did not. However, SAP "did not move the countries to a more sustainable path for two basic reasons: although price changes improved economic efficiency, higher production levels increased aggregate environmental impacts, and the economic reforms did not internalize environmental and social costs because requisite policy reforms did not accompany the economic corrections" (Reed, 1996: xx).

Reed (1996) stresses that SAP should be viewed as the programmatic means of integrating the developing countries' economies into the global market system. Removal of both external (trade) and internal market barriers and reduced government interventions are "increasingly placing natural resources more directly under the control of the international market system. .. Price signals from international markets ... are now preeminent in defining the rates and conditions under which those resources are used as well as who the beneficiaries will be" (page 350).

What has been the implications of the new market incentives on the resource use? From the nine country studies, the report concludes that "a principal response of extractive economies to structural adjustment programs was to expand and intensify extraction of natural resources to be traded on international markets" (page 329). The environmental impacts have been quite damaging, and unsustainable rates of resource extraction in sectors such as forestry and mining have often been further boosted.

The response of agricultural economies have been more mixed. Commercial farmers have responded to new price signals by expanding and often diversifying production, which may have both positive and negative environmental effects, depending on factors like the type of crops being expanded, the degree of soil mining, etc. The response of smallholders have been quite different. Deteriorating economic and social conditions during the transition phase have lead to increased pressure on marginal land. The removal of input subsidies in many African countries moved agricultural inputs and credit beyond the reach of many small farmers, leading to more extensive land use practices and deforestation. This is in line with the subsistence approach discussed in section 4.1.1.

The SAPs clearly hold the potential for promoting both economic growth and environmental conservation, as repeatedly stressed in World Bank publications (e.g., World Bank, 1992). In practice such win-win gains have often not been realized because SAPs have not been accompanied by the necessary policy and institutional reforms. This reflects both "the lack of intentionally to use the adjustment process to strengthen national environmental performance" (Reed, 1996: 328), and the fact that particularly institutional reforms are much more difficult to implement than some of the basic "getting the prices right"-reforms. SAPs have boosted the economic growth and

provided new incentives for resource extraction, without undertaking reforms that could counterbalance the increase pressure on the environment created.

The first study tried to examine more directly the relationship between debt and deforestation. In none of the three countries (Côte d'Ivoire, Mexico and Thailand) did the researchers find any conclusive evidence for the debt-environmental degradation thesis.

6 Global environmental markets

The discussion so far demonstrates an insufficient integration in domestic policies of global environmental concern related to particularly deforestation. It is therefore a continuous discussion -- not at least in the aftermath of the Rio conference in 1992 -- on how to create mechanisms at the international level which can promote resource conservation in developing countries. Some of these measures are related to aid and "green conditionality". In this section we discuss to other measures: debt-for-nature swaps and international markets for CO_2 emissions.

6.1 Debt-for-nature swaps

Debt-for-nature swaps are, simply stated, contracts between a tropical forest country and another party (NGO, private company, or government) where part of the country's debt is bought up, in return for the conservation of a natural area in the tropical country.[12] The direct effect of the contract is that a particular area (habitat) is protected. The indirect effect is that reduced debt may have a number of additional positive consequences for the country, including more environmental conservation, through several possible channels. The contract makes it possible to fully compensate the owners or users of the protected areas. In this way the government could solve the problem of conservation *vs.* development without resistance from local land owners or users. The deal may also strengthen the capacity to manage land resources in a more sustainable manner (Panayotou, 1993).

This paper has questioned the significance of the indirect effect of debt reduction when it comes to deforestation. It may, however, be possible to include in the contract other conditions which attempt to direct the increased financial resources in the hands of the government towards activities that will enhance resource conservation beyond the direct effect. However, we would like to emphasize that the direct conservation effect as well as other positive effects of debt relief provides sufficient justification for debt-for-nature swaps.

So far the market for debt-for-nature swaps has been very thin in terms of the volume traded, and costly in terms of transaction costs. They are largely based on good-will by groups in the North, devoid of strong self-interests on the part of the groups buying the debt. Hence, a more recent focus has been to look at the possibility of creating global markets for tropical forest conservation, where both parties have a direct economic interest in the deal.

[12] See Hansen (1989) for a discussion.

6.2 International markets for CO_2 emissions

A fundamental problem with tropical forest conservation is the "global appropriation failure" (Pearce and Brown, 1994). A large share of the benefits of rainforest conservation are global, such as carbon storage, biodiversity conservation and existence values. These benefits are not appropriated by the resource users, who take the decisions that determine the fate of the forest. The users decisions do not reflect the global benefits of conservation, and forest conversion becomes too large. The key issue is then how to create mechanisms which allow the resource users, both at the local level and national governments, capture some of global benefits of conservation.

The main global benefit of tropical forest conservation seems to lie in its carbon storage function. Monetary estimates are typically in the range of USD 2 - 3 000 per hectare, based on the costs of similar reductions in CO_2 emissions in rich countries (Pearce, 1994). This compares very favourably to an annual output value of one hectare forest converted to agricultural land of only a few hundred dollars. Thus, if the developing countries where paid for letting their forest act as carbon sinks to reduce CO_2 emissions and halt the greenhouse effect, this would in many (most?) cases outweigh the costs of forsaking all other uses.

Norway has already entered an agreement of joint implementation through the Global Environmental Fund (GEF) with Poland (converting from coal to natural gas) and Mexico (energy efficient lighting). Private sector initiatives are also on their way, for example, on forest rehabilitation in Indonesia, Equador and Costa Rica (Pearce, 1994).

These initiatives, like the debt-for-nature swaps, are small and not likely to change the overall trends. A larger scale arrangement would be needed to make a significant impact. Consider a proposal which has been around for some time in the debate: all countries agree on a CO_2 agreement, and each country is given a certain amount of emission quotas, which can be traded in an international market. The agreement should include both emissions due to fossil fuels, as well as emission (absorption) of CO_2 due to changes in biomass (including de-/reforestation). This would create strong incentives for the forest-rich countries to conserve their forest. They could now liquidate standing forest by preserving it and selling (or buying less) CO_2 quotas, not by cutting down the forest.

Even with new evidence about the greenhouse effect, a binding international CO_2 agreement is not likely in the near future. Consider as an alternative a stabilization at 20 percent below current emission levels, as recommended by the Toronto conference in 1988, where the tradable quotas are given to each country in proportion to their population. This would imply huge costs to the rich countries. The United States, for example, would have to buy quotas every year for an equivalent of 6 percent of their GNP (Kverndokk, 1993). This also explains the resistance so far from countries like the US against any binding climate agreement (although the US position has soften up recently).

Another problematic issue with the per-capita allocation of quotas is that forested countries would be severely punished for cutting trees. They could question why they should be punished for reducing their forest cover, given that other (more developed) countries have done the same decades or centuries ago? Any realistic quota distribution must take into account a number of factors such as population, present emission levels, etc.

Bergesen (1995: 57) concludes in a review of possible global climate regimes that "while the theoretical attractions [of tradable quotas] are indisputable ..., the practical and institutional obstacles to such a system remain formidable. ... It may take a decade or two before governments in North and South muster enough joint ambition and joint political will to permit joint implementation". In the meantime, the main role of Northern governments will be to provide technical assistance, capital and technology, in particular to the energy and forestry sectors, and to push for domestic policy reforms.

In a global perspective a convincing explanation of (excessive) deforestation is the "global appropriation failure", and the logical solution is to create international markets for transferring some of the "willingness to pay" for forest conservation to the resource users in tropical countries. The large political and practical impediments to this suggestion make us -- at least in the foreseeable future -- rely on domestic policy reforms, and international pressure and assistance to move the policies in a conservationist direction.

7 Summary and concluding remarks

We will sum up our findings and views in five main points. First, whereas it is possible to hypothesize about a number of links between indebtedness and deforestation, the empirical evidence level does *not* provide support for the alleged general positive correlation between debt and deforestation.

Second, even though a general link between debt (and other macro level variables) and deforestation is hard to establish statistically and otherwise, it does not follow that such linkages should be ignored when designing economic reform programmes for individual countries. For example, in some countries export promotion may be good for the environment, in others it may have an adverse impact.

Third, the inability of most macro level variables to explain the rate of deforestation indicates that the focus should rather be on micro level reforms. This would include respect for property rights of traditional user groups, establishment of conservation areas with buffer zones, creating local benefits of forest conservation (like the CAMPFIRE project in Zimbabwe[13]), careful planning to avoid making virgin forest areas easily accessible through infrastructure investments (roads), and providing attractive off-farm employment to reduce the pressure on forest resources.

[13] Note that the main benefits accruing to the local population derive from elephant hunting licenses. Additional benefits of even higher value could have been obtained for the villages if they were allowed to sell the tusks (ivory), but international regulations and environmental boycotts have made this impossible.

Fourth, we would question the validity of global level statistical analyses, partly because of the immense data problems, and partly because the underlying assumption about homogeneity across countries. Country-specific studies, and systematic aggregation of micro level studies, seem to be a more fruitful approach to derive some general lessons about how debt and other macro level and international variables influence natural resource use. Indeed, the major drawback with macro level studies is the lack of clarity and specification of the on-the-ground mechanisms behind deforestation. A firm understanding (and modelling) of the decision-making process by the deforestation agents is necessary to understand how macro level and policy variables affect deforestation (Angelsen, 1996).

Fifth, there are a number of good reasons for debt relief, but reduction of deforestation rates does *not* seem to be among them. It is also hard to find evidence supporting the view that deforestation would have been less severe if the debt crisis had not occurred.[14] We may, nevertheless, argue that indebtedness limits the range of options for governments -- both for environmental conservation and environmental destruction. Reducing the debt burden widens the opportunities for better environmental policies -- whether these opportunities will be seized upon is another question.

[14] Obviously, if the debt crisis was avoided because of better economic management, the deforestation rates could also have been lower.

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Appendix:

Country	Annual deforestation	Debt service as pct. of export		
	1981-90	1980	1985	1990
Africa				
Algeria	0.8	27.4	33.3	59.4
Benin	1.3	6.3		3.4
Botswana	0.5	2.1	5.4	4.4
Burkina Faso	0.7	5.9		6.4
Burundi	0.6	9.5	16.6	43.6
Cameroon	0.6	15.2	10	21.5
Central African Republic	0.4	4.9	11.8	11.9
Chad	0.7	8.3		5.1
Congo	0.2	10.6	19.6	20.7
Côte d'Ivoire	1	38.7	17.4	38.6
Ethiopia	0.3	7.3	10.9	33
Gambia	0.8	6.3		
Ghana	1.3	13.1	12.2	34.9
Guinea	1.2	19.8		8.3
Kenya	0.6	21	25.5	33.8
Madagascar	0.8	17.1	19.6	47.2
Malawi	1.4	27.7		22.5
Mali	0.8	5.1	16.6	11.5
Mauritania	0	17.3	19	13.9
Mauritius	0.2	9.1	11.5	8.7
Morocco	-1.5	32.7	32.7	23.4
Niger	0.4	21.7	26.7	24.1
Nigeria	0.7	4.2	30.8	20.3
Rwanda	0.3	4.2	4.3	14.5
Senegal	0.7	28.7	9	20.4
Sierra Leone	0.6	23.2	5.7	15.9
Tanzania	1.2	25.9	16.7	25.8
Togo	1.5	9	27.5	14.1
Tunisia	-1.9	14.8	24.9	25.8
Uganda	1	17.3		54.5
Zambia	1.1	25.3	10.2	12.3

Country	Annual deforestation	Debt service as pct. of export		
	1981-90	1980	1985	1990
Zimbabwe	0.7	3.8	32.2	22.6
Asia				
Bangladesh	3.9	23.2	16.7	25.4
India	0.6	9.3	9.3	28.8
Indonesia	1	13.9	19.9	30.9
Malaysia	2	6.3	22.3	11.7
Myanmar	1.3	25.4	51.4	
Nepal	1	3.2	4	18.2
Pakistan	3.4	17.9	29.5	22.8
Papua New Guinea	0,3	13,8	10,4	36
Philippines	3.3	26.6	15.9	21.2
Sri Lanka	1.4	12	13.9	13.8
Thailand	3.3	18.9	14.7	17.2
Latin America				
Argentina	0.1	37.3	41.8	34.1
Bolivia	1.2	35	29.1	39.8
Brazil	0.6	63.1	26.5	20.8
Chile	-0.1	43.1	26.2	25.9
Colombia	0.7	16	29.2	38.9
Costa Rica	2.9	29.1	36.6	24.5
Dominican Republic	2.8	25.3	16.1	10.3
Ecuador	1.8	33.9	28.8	33.2
El Salvador	2.2	7.5	16.3	17.1
Guatemala	1.7	7.7	21.3	13.3
Honduras	2.1	21.4	17.6	40
Jamaica	7.2	19	36.5	31
Mexico	1.3	48.1	37	27.8
Nicaragua	1.9	22.3		4.1
Panama	1.9	6.3	6.9	4.3
Paraguay	2.7	18.6	12.9	11
Peru	0.4	44.5	7.9	11
Trinidad and Tobago	-2.2	6.8	7.1	14.5
Venezuela	1.2	27.2	12.8	20.7

Sources: World Bank (1992, 1995); deforestation rates are based on FAO (1993).

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