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Natural Resources and Agricultural Development in the Tropics: Is Conflict Inevitable?

ON RESOURCE DEGRADATION

I suggest that there are three general classes of resource degradation in the tropics: the first arising from explicit policies to exploit natural resources (or resource-based agricultural commodities) for economic gain, and the latter two arising from more subtle policy choices. While the first category of degradation receives much of the attention of environmentalists, I will suggest that it is the latter two categories that may, in the long run, pose more serious threats to the natural resource base in the tropics.

INTENTIONAL DEGRADATION

The explicit policies that generate conflict between economic development and the natural resource base are those where intentional resource degradation is carried on by governments to promote the sale of tropical timber, minerals, fish, or other natural resources for purposes of export. Equally serious is the cultivation of certain agricultural crops that are important in export markets and the disregard for the environmental implications of those practices because of the critical need for the export income. The foreign exchange earnings are then used to import manufactures or heavy machinery with which to satisfy an industrial need, or fancy consumer goods to satisfy the wants of an urban élite that requires solicitude on the part of governments. The problem is one of an important macroeconomic demand for foreign exchange, the use of the natural resource and agricultural sectors to generate that foreign exchange and the unwillingness of the government to confront the interests of those engaged in resource destruction. This reticence on the part of government is often reinforced by a need to ensure that the foreign exchange requirements are met. After all, there are not only things to

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import, but much foreign assistance consists of loans that must be repaid in hard currencies.

The colonial history of most tropical countries can be understood as a major contributing factor in this particular pattern of resource use. Their early economic development was one of an imposed structure with the explicit intent being to provide the colonising power with desired raw materials or agricultural products. With export-driven resource policies being the accepted norm, we cannot expect a rapid reorientation.

The most recent (1980) data for 24 tropical countries considered by the World Bank to be 'low income' reveal that, on average, the two most important export commodities in each of the countries accounted for 64 per cent of foreign exchange earnings. Of these 24 countries – 17 of which are in sub-Saharan Africa – coffee and cotton were the primary exports of 12, with 12 other commodities being first in the remaining 12 countries (rice, gas, textile fabrics, alcohol, copper, clothing, animals, tea, pearls, ores, fertilizers, and cocoa) (World Bank 1984b; United Nations 1983). Eleven of the 24 countries derived more than 50 per cent of their foreign exchange from only one commodity – five of them from the export of coffee, then one each from rice, cotton, animals, pearls, ores, and cocoa. These 24 low-income countries used, on average, 66 per cent of their foreign exchange earnings to import just two general classes of imports – manufactures, and machinery and transport equipment; only in three cases did the top two imports show up as something else – in one case it was food and in two cases it was fuels.

Turning to the 31 middle-income countries, a similar picture emerges. Here, these 31 countries derived almost 60 per cent of their total foreign exchange earnings from two primary commodities: nine of them had petroleum as the first export, while six had coffee as the first export. That is, 15 countries had only two commodities (petroleum and coffee) as the primary earner of foreign exchange. Only nine other commodities were the major export of these 31 countries (iron ore, copper, fruit, rice, fertilizers, sugar, chemicals, clothing, and cotton). Ten of these 31 countries had more than 50 per cent of their foreign exchange from only one commodity, of which petroleum was the dominant export in five countries, followed by ore, copper, sugar, chemicals, and coffee in the remaining five countries.

As with the 24 low-income countries, these 31 middle-income countries used, on average, 66 per cent of their foreign exchange earnings for the importation of machinery and transport equipment and for manufactures. In contrast to the low-income countries, the middle-income countries are more serious importers of fuels, with approximately 39 per cent showing fuels as either the first or second most important claimant on foreign exchange.

We have the familiar situation of these 55 low- and middle-income tropical countries relying on one or two commodities for the vast majority of their foreign income, and using the greater part of that foreign exchange to import manufactures or fuel.

The direct relationship between explicit government policy and natural resources can be illustrated with reference to gum arabic (*acacia senegal*) in the Sudan. The Sudan has historically accounted for approximately 80 per cent of the world's total production of gum; gum exports from the Sudan account for approximately 10 per cent of total foreign exchange earnings. These conditions render the Sudan vulnerable to swings in the demand for gum and in recent years the development of synthetics has posed a serious threat. But an equally serious threat arises from internal management of gum pricing by the state buying organisation, the Gum Arabic Company.

When prices are set too high there is an incentive to over-harvest gum by excessive tapping; this is compounded in times of drought when the trees are less hardy. Many of the gum trees are found on state lands with uncertain tenures and so these are particularly vulnerable to herders moving through. Conversely when prices are set too low, farmers will move into other crops and often cut down the gum trees for fuel or charcoal, and to make room for other crops.

The government can ill afford to lose even 10 per cent of its foreign exchange earnings; over the recent past the average annual rate of change in exports has been a minus 5 per cent, while imports have been growing at about 4 per cent per annum (World Bank 1984a). Recently, energy imports have required about 40 per cent of total export receipts. Hence gum arabic exports are essential and yet the gum sector is in disarray. A failure to manage this particular resource – rather insignificant on a global scale, yet of paramount importance to the Sudan – would bring added hardship to a country already suffering severe financial and environmental stresses.

This same story could be told about a number of other developing countries. For the non-oil exporting developing countries in Asia (excluding China), current-account deficits in 1984 averaged 4.1 per cent of the export of goods and services. Yet for similar countries in Latin America the percentage was 15.5, and in Africa it was 28.7 per cent (IMF 1984). A sample of 90 developing countries shows that between 1970 and 1983 the ratio of debt to GNP doubled (from 13.3 to 26.7 per cent), the ratio of debt to exports increased by 20 per cent (from 99.4 to 121.4), the debt service ratio (interest plus amortisation divided by the value of exports) increased from 13.5 to 20.7 per cent, and total debt outstanding increased almost tenfold (from $68.4 billion to $595.8 billion) (IMF 1984). For the period between 1965 and 1981, all developing countries taken together increased the value of their exports by a factor of 11 (in constant dollars). Over that same period the low-income Asian countries increased their exports by a factor of 7, while the low-income African group managed to increase the value of their exports by a factor of only 3.5 (World Bank 1984b).

The export structure of the developing countries is absolutely dominated by the natural resource sector either directly through minerals, timber, petroleum, or fish, or indirectly through the export of

agricultural crops whose future production depends upon the wise use of land and water resources. We will return to this below.

UNINTENDED DEGRADATION

The second class of resource degradation arises from government policies that may actually be formulated with resource protection in mind. As new nation states emerged following the demise of colonialism, governmental organisations were created reflecting those observed in more industrialised societies. Ministries of agriculture were created, often with a division of forestry or forest management. A few countries elevated forestry or mining or fisheries to the full status of a ministry. With these organisations in place it was not long until the myth of management was given effect by the passage of laws and the development of administrative rules that redefined an individual's rights and duties with respect to the forest, to minerals or to the fishery. A number of countries passed laws that prohibited the cutting of firewood or that outlawed certain fishing practices. This evolution of resource management by proclamation created perverse incentives at the local level where it suddenly became an act of honour to defy absurd institutional arrangements – as well as a necessity for survival.

In Nepal the government in 1957 nationalised all forest lands that had previously been under the management and control of the local village (*panchayat*). The villagers were thus moved to get what they could from these lands before the transition took place. Villagers who had previously operated under a well defined set of rights and duties *vis-à-vis* the forest suddenly found themselves with no rights and only duties (Bromley and Chapagain 1984). The government of Nepal is now attempting to restore those local-level management systems – really institutional arrangements – in the hope of arresting continued resource destruction.

Some would argue that contemporary resource degradation in the Sahel is quite often the fault of government policies that divorce local users from responsibility for conservation, while at the same time creating negative incentives that discourage villagers from innovating local-level institutional arrangements that might result in improved resource-use practices (Thomson 1977). Forestry codes that outlaw cutting of necessary fuel wood without accompanying programmes of supply augmentation simply invite open defiance of the law and are, over the long run, quite counterproductive. This long-run problem is caused by an attitude of contempt for the national government, the knowledge that certain individuals have bribed their way out of difficulties, and the realisation that the national government has no plan to deal with the very real resource shortages at the village level.

It is this myth of management at the national level and indifference or contempt at the local level that poses a very serious threat to natural resource integrity in the newly independent states in the tropics.

Turning from government-mandated institutional change, there are instances of government-promoted technological change in fisheries that resulted in the destruction of fish stocks and which set in motion social processes that destroyed long-standing institutional arrangements defining the fishing population with respect to the natural resource, as well as with respect to others also fishing (Cordell 1978). We find this problem particularly acute where governments have thought they were 'helping' a fishery by subsidising more powerful fishing boats and gear.

COMMERCIAL AGRICULTURE AND NATURAL RESOURCES

The final class of resource degradation arising from economic policies are directly related to agricultural development strategies. Specifically, I have in mind national policies directed toward self-sufficiency in certain food crops and the export of certain cash crops that may be grown under plantation conditions. While not openly directed toward resource extraction, this policy-level determination of land use imperatives often holds important implications for the structure of agriculture and hence its technological aspects. As part of this determination, we must be aware of the human implications of modern agriculture and its labour-absorptive capacity.

When agriculture cannot absorb increased population growth because of policy-induced mechanisation or because it is inherently capital intensive, then individuals become marginalised. Forced from the lowlands, they end up in the swelling urban slums of Manila, Calcutta, Bombay, Lagos, Abidjan, Nairobi, Jakarta or Bangkok, or, more critically for natural resources, in the uplands, on lands of decided inferior quality, or on fragile habitats that can ill afford more human pressure.

Recently published data from the Philippines indicate that (in 1970) approximately 30 per cent of the total population of the country resided in the uplands. This represented over 50 per cent of the total migrant population in the Philippines – the remainder having gone (apparently) to urban areas in the lowlands [Cruz 1984].

This marginalisation of people occurs in precisely those areas where institutional arrangements are the least developed regarding their ability to deal with this new resource pressure. That is, in the uplands resource use has traditionally been guided by custom and local-level institutional structures that were based upon an individual's membership in the group. When migrants invade the uplands, not only are indigenous institutions unable to adjust rapidly enough but, more importantly, they are not even appropriate for the new mix of resource users. Here we are talking about the derived resource destruction in the tropics that emanates from commercial agricultural policy that may seem quite removed from natural resource integrity. Of course part of this can be found in the heavy use of chemicals in agriculture; that too causes unintended problems for resource integrity. But an equally serious problem – and one that has not

received much attention – is that associated with the marginalisation of people. In Indonesia we see it in the form of government-organised migration to the outer islands; in Latin America it takes the form of colonisation efforts in remote regions. While in other countries these practices may be less obvious, they are still present.

The serious threat for natural resources, as indicated above, is that the migrants bring with them an alien institutional structure for guiding resource use and these patterns of use may fit in quite badly in the new location. If they have the ability to impose their will on the original residents then serious problems can arise in terms of resource use. Even if they fit in with prevailing resource-use patterns, their numbers will be enough to pose a serious threat to the resource base.

THE ECONOMIC ISSUES

Agricultural development and resource degradation are serious problems over the long run because the poor tropical countries now lack the critical management skills in the biological and social sciences relevant to natural resource policy. More important, the major development-assistance agencies seem unwilling to help these countries obtain such skills. There seems to be a sustained drift away from investments in human resources; what investments do seem probable on the horizon are likely to be concentrated in the glamorous fields of biotechnology. The hard work of devising resource management schemes that are supportive of needy rural populations, yet protective of the long-term resource base, will be ignored. Science will proceed in search of the 'miracle technical fix' in agriculture and it will relegate to a secondary role the very real needs for innovative resource management.

The food problem in much of the developing world, coupled with conscious government policies to extract foreign exchange from the resource sector, will surely continue to cause severe pressure on the natural resources of the tropics. At the extensive margin the most serious problems are found in overgrazing, deforestation, the killing of wild animals, and the compression of slash-and-burn systems into shorter fallow cycles. As crop agriculture moves into new areas, habitat is destroyed and soil erosion can become serious. At the intensive margin the conflicts are likely to come from the increased use of chemicals in agriculture and from the homogenisation of the ecosystem to conform to the economic imperatives of modern commercial agriculture (Norgaard 1981). Continued reliance on chemical pest control will simply result in increasingly resistant pests; cotton pests in the Sudan are now much less controllable by chemical means and this situation is surely duplicated elsewhere. The plant geneticists are but a 'few steps ahead' of ever more creative enemies.

In the intermediate zones of agriculture – much of South Asia, and parts of Africa and Latin America – increased food production is coming not from increased yields but from an expansion of the cultivated area.

When this expansion moves agriculture into ever more fragile areas (and particularly steep slopes) the potential for resource degradation increases dramatically.

In regions where slash-and-burn agriculture is still practised, the encroachment of sedentary agriculture, coupled with local population growth, has brought a compression of the fallow period and a resulting serious loss of productivity.

Finally, at the extensive margin (parts of South Asia and North Africa) resource destruction is bound to continue into the foreseeable future and there seems to be little that can be done. In contrast to an 'urban' agriculture such as rice or even wheat, the nomadism of this part of the world makes public policy most difficult to implement. The very discipline of intensive agriculture lends itself to policy adjustments. By way of contrast, nomadism is much less amenable to policy implementation.

Economists concerned about agricultural development and natural resource problems in the tropics must bring to the enquiry a very clear understanding of colonial history; there are but four or five countries in all of Africa and Southeast Asia that were not colonised at one time. Agriculture and natural resource management are profoundly influenced by this history. At the local level, economic and social behaviour will have at least three guiding norms: (1) traditional; (2) colonial; and (3) newly independent nation state.

Under traditional norms, certain agricultural practices and also natural resource practices were proscribed by a variety of sanctions and taboos. Colonial administrations imposed markets and cash on many local areas and rendered local resources subject to exogenous prices and demand conditions. Now, newly independent nation states are attempting to impose yet a third layer of institutional arrangements on resource users. This 'institutional layering' is a situation where traditional and colonial institutions that favoured one particular use of resources in a particular manner are now confronted by new and exogenously imposed institutions that are the product of an emerging state. Independent agents are then faced with three overlapping but not coincident opportunity sets from which they will choose how to behave. In any society where enforcement of the rules is haphazard, it should not surprise us that problems arise when enforcement must deal with several institutional structures (Bromley 1985).

Economic policy will require much more attention to matters of compliance and enforcement; economists cannot assume compliance with the mandated rules precisely because there are several incongruent institutional structures (rules) that bear on the individual's relationship to natural resources, and to others who have traditionally used those resources. This matter of *institutional dissonance* presents a rich opportunity to economists concerned with natural resources in the developing world.

Economists will need also to reconsider their preoccupation with

rather conventional benefit-cost analysis when addressing resource questions in the developing countries (Hufschmidt and Hyman 1982). I suggest that most economists, feeling good about the very notion of 'development', regard economic change in rather standard Paretian terms. That is, once we have conducted a benefit-cost analysis and found that the net present value of benefits from doing something is positive, then it seems safe to conclude, at least on 'efficiency' grounds, that it is good to proceed. This sanguine view of change overlooks a critical aspect of life 'out on the ground'.

Often overlooked by the optimistic notion of potential Pareto improvements is that there is some disagreement about whether agricultural producers are 'attracted to' change, or are rather 'forced into' change (Boserup 1966). This is relevant in the context of an individual producer attempting to decide about particular agricultural practices. If a farmer is less than confident that all the promises of some new approach will be realised – and many farmers in the developing world have ample empirical grounds for such caution – then change may not be undertaken until the costs of not changing become quite high. This is a subtle, yet important, distinction. That is, the benefits of change are here suggested to be often different than the costs of not changing.

As every good welfare economist knows, the promise of a Pareto improvement tends to confuse the *potential* for compensating those made less well off by the proposed change with *actual* compensation. Since actual compensation rarely, if ever, occurs, the losers from change may be excused their lack of enthusiasm. To be told not to worry, that net national income will go up even though you will be harmed, is scant solace to the losers.

But the real issues in natural resource policy in the developing world pertain to the rate of use of renewable resources and the nature of capital formation that attends the exhaustion of non-renewable resources. Much resource degradation is the result of harvesting rates that exceed the sustainable yield rate of renewable resources. If renewable resources are driven to exhaustion and if non-renewable resources are depleted without making constructive use of that capital for sustained development purposes into the future, then the tropical countries are clearly mortgaging their future. Natural resources are not only the literal frontier of most tropical countries but they are the institutional frontier as well. It is with respect to natural resources that the public policy process is most hampered by conceptual, biological, and political problems. In parts of the world the concept of time – so important in the concept of conservation – is not linear, as it is in the West, but is instead cyclical; try discounting the future in that view of time.

As economists, our contribution to these resource degradation problems will require a sense of purpose and commitment. We will often deal with politicians whose rate of time preference is exceedingly high. We will deal with biologists whose notion of 'wise use' may mean 'no use'. And we will deal with some economists who favour doing whatever is

judged on Pareto grounds to be efficient. Our most lasting contributions, however, will be found in the way that we help policy-makers to understand: (1) the nature of the existing problem; (2) the feasible alternatives to solve that problem; and (3) some general sense of the winners and losers that will result from the possible solutions. The ability of many tropical countries to avoid ecological disaster may well depend on the nature of our involvement in that process.

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