Forestry
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Tropical Forestry For Sustainable Development

by

Norman Myers

October 1990

Forestry For Sustainable Development Program
Department of Forest Resources
College of Natural Resources
University of Minnesota
St. Paul, Minnesota 55108

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PREFACE

The author of this paper, Dr. Norman Myers, is an associate in the Forestry For Sustainable Development (FFSD) Program at the University of Minnesota. This paper was presented at a workshop on "Forestry For Sustainable Development", held at the University of Minnesota, March 3, 1989, by the FFSD Program. It is the seventh in a series of working papers produced for the Forestry For Sustainable Development FFSD Program that represent work in progress. Their purpose is to stimulate discussion among individuals interested in forestry for sustainable development.

The major objectives of the FFSD Program are to:

1. Improve the availability and usefulness of existing technical knowledge related to forestry for sustainable development - translate state-of-the-art scientific and technical information into practical and easily usable management guides and training materials that can be used effectively in planning and implementing development projects that will contribute to sustainable development; and

2. Improve the policy and organizational environment to encourage application of sustainability strategies - identify and develop effective institutional mechanisms, both at the policy and project levels, for introducing sustainability strategies into the development planning process at an early enough stage to influence project or program design.

The focus of the Program is on social forestry and related strategies within a watershed management framework as an integrating mechanism for moving toward sustainability in land use and in natural resource-based development projects. It involves an interdisciplinary group of faculty from the University of Minnesota, and associates at the University of Arizona, Yale University, Oxford University, the InterAmerican Development Bank, and other development groups. The FFSD Program is part of the University of Minnesota's Center for Natural Resource Policy and Management in the College of Natural Resources.

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For further information regarding the FFSD Program, contact:

Dr. Allen L. Lundgren, Program Director (612) 624-1277, or
Dr. Hans M. Gregersen, Professor (612) 624-6298
Department of Forest Resources
115 Green Hall
University of Minnesota
1530 North Cleveland Avenue
St. Paul, Minnesota 55108, U.S.A. Fax: (612) 625-5212

TROPICAL FORESTRY FOR SUSTAINABLE DEVELOPMENT

by
Norman Myers[1]

INTRODUCTION

The rationale for sustainable development amounts to this: much economic activity depends on the environmental-resource base, in the form of soils, water, vegetation and climate, that ultimately underpins virtually all human endeavor. This environmental-resource support is obviously important for forestry, also for agriculture, fisheries and hydropower generation among other major development sectors. These considerations are especially significant for developing countries, in that a greater share of their economies is usually dependent on the environmental-resource base than is the case with developed-world economies. At the same time, moreover, the developing-countries' resource base, being generally tropical in location, is more "fragile" and hence susceptible to depletion than is the case with temperate-zone countries. There is thus a premium of safeguarding the environmental-resource base as an integral part of those processes known as sustainable development.

Indeed it is not going too far to say that degradation and destruction of environmental systems and their associated natural resource stocks are now assuming massive proportions in many developing countries, to the extent that they threaten the very prospects for continued sustainable development. Fortunately it is now widely recognized that economic development itself can be an important contributing factor to the spread of environmental problems in the absence of appropriate safeguards. To cite the World Bank (1985), "A greatly improved understanding of the natural-resource base and environment systems that support national economies is needed if patterns of development that are sustainable can be determined and recommended to governments."

From this introductory outline, we can derive three conclusions:

1. The environmental resource base, being the ultimate support of much economic activity, makes a critical contribution to the cause of sustainable development;

2. In developing countries especially, environmental resource stocks are increasingly being depleted (forests are being eliminated, soil eroded, grassland over-grazed, and the like) to a degree that adversely affects the prospects for sustainable development; and

3. There is urgent need for policy makers to be supplied with an analytical framework for the problem, especially so that they can systematically evaluate some tradeoff factors involved, and determine the optimally efficient points for policy interventions.

These considerations apply more to developing countries than to developed countries, insofar as the former countries are generally primary producers with large subsistence

[1]Consultant in Environment and Development, Oxford, England.

sectors, and hence more dependent on their natural resource systems, notably land and water.

This paper addresses these issues, with emphasis on linkages, both environmental and economic, between various categories of natural resource systems and development sectors--and with particular emphasis on forestry. It thus highlights certain spillover effects, principally in the form of lateral and temporal externalities.

The key questions are these: What sorts of resource depletion are underway? What is their scale and scope? What types and levels of depletion are significant, serious, critical, intolerable? Are there thresholds of irreversible injury? What are some forms of interconnection between various categories of resource depletion? How, and to what extent, does resource depletion--in the case of the present paper, depletion of tropical forests--generate adverse impact on leading development sectors, such as food production and public health?

DEFORESTATION: ILLUSTRATIVE EXAMPLE OF CONCEPTS AND LINKAGES

To illustrate the character and extent of resource depletion, together with some of the complex linkages at work, let us look briefly at the issue of deforestation. Tropical forests not only produce wood, whether commercial timber or subsistence fuelwood. They act to protect soils, to retain moisture and to offer all manner of other environmental services. When they are unduly degraded or destroyed--whether through over-heavy logging, fuelwood gathering, or clearing for agriculture of various kinds--the loss almost invariably extends far beyond the elimination of a source of wood. It extends to the productive capacity of the soil, that can be rapidly diminished through nutrient leaching, laterization, desiccation and outright erosion. Sometimes soil fertility is irremediably reduced--"irremediably" in that the time required to make good the damage will prove longer than local farmers can wait, and/or in that the costs of technical responses in the form of, for example, fertilizers are greater than farmers can sustain.

A further serious repercussion arises in areas far removed from the site of deforestation. Downstream river systems become subject to water flows that are excessive during the rainy season and unusually low during the dry season, leading to the flood-drought cycles that now characterize many river systems below deforested watersheds, notably in Southern Asia. The adverse consequences affect not only flood-prone lands but also irrigation-dependent croplands. Furthermore, washed-off soil and other erosion debris causes downstream river beds to build up, aggravating the risk of flooding. It also leads to the sedimentation and siltation of irrigation channels, reservoirs, natural lakes, harbors and offshore waters. In turn, these linkages adversely impinge upon irrigated agriculture, hydropower installations, domestic water supplies, port facilities, and fisheries, both inland and coastal.

Still further unwanted consequences arise from deforestation, this time through linkages that are less direct and more diffuse. As forests are "mined" for fuelwood, and as a potentially renewable resource is harvested to effective extinction, rural households start to divert animal manure and crop residues from farm fields to house hearths. Fertilizer benefits give way to fuel needs, even though cropland productivity is further reduced. It is estimated

(Spears and Ayensu 1986) that in developing countries of Asia and Africa alone, at least 400 million metric tons of dung are burned each year; and each ton means a loss of at least 50 kgs. of potential grain grown, or a total of 20 million tons of grain per year (some analysts calculate the total at twice as much). To put this calculation in perspective, 20 million tons of grain can feed 100 million people for one year. To purchase the grain on world markets could cost as much as $3 billion--a figure to bear in mind when we consider the cost of establishing fuelwood plantations, variously estimated at between $900 million and $1.3 billion a year for ten years (World Resources Institute and World Bank 1985).

Thus the use, or rather the misuse and overuse, of the total natural resource represented by forests, generates a backlash effect on other natural resources, such as soils, water, hydropower potential, fish stocks, gene reservoirs, etc. In turn, shortcomings in the forestry sector spill over onto agriculture, energy, public health, communications and fisheries, among other development sectors. These lateral externalities are paralleled by temporal externalities. Present use degrades the natural resource base to the detriment of the current generation in subsequent years, and even of generations into the indefinite future.

CENTRAL ISSUE: THE ENVIRONMENT AS A SECTOR OF DEVELOPMENT

Thus deforestation illustrates the many interdependency relationships between the natural world and man's world. In turn, this means that our approach to natural resource systems should not be perceived in terms of restraints on development (an approach that ostensibly diverts funds and effort away from the goal of economic growth). Rather, we should regard environment as a valid sector of development itself, or an overarching sector that addresses the dynamic interactions between other sectors. Furthermore, the key question is no longer: "How can we best safeguard the environment?" It becomes: "How can we best make productive use, indeed expanded use, of our natural resources in order to further human welfare now and forever?"

FURTHER ILLUSTRATIVE EXAMPLE: WATER RESOURCES

Water is an eminently renewable resource--and its flows, hence its services, often stem from upland catchments whose hydrologic functions are determined, to some extent at least, by the vegetative cover, notably forests. Water stocks are available for recharge, either through natural hydrologic cycles or through man-directed means. Yet all too often, water is used as a nonrenewable resource. Worse, it is rarely available in the right amount at the right place at the right time, largely because precipitation is either excessive or deficient. Moreover, demand for water in several parts of the world is increasing several times more rapidly than are population numbers, due mainly to rising standards of living.

As a measure of the imbalance between water needs and supplies, and with regard to the public health sector alone, there are now 135 million more developing-world people without access to clean water or adequate sanitation than in 1970. This is significant for water-related diseases that account for 80 percent of all sickness in developing countries, and for 90 percent of the 15 million child deaths each year. Until child mortality of this order can be reduced, there is all the less prospect for family planning programs, with all that implies for population growth and development progress overall. Yet the mega-scale budget for the United Nations Water and Sanitation Decade, $300 billion over a period of ten years, makes

no provision for safeguarding of water supplies from their principal source, i.e., forested catchments.

Water shortages impact even more heavily on agriculture. Irrigated croplands, now constituting about 15 percent of all arable lands, produce 30 percent of all food, but account for 65 percent of water used worldwide; and more than half of all irrigated lands are in developing countries. Irrigation agriculture uses seven times more water than the next two water-demanding activities together, viz. domestic needs and industry. Yet in several of the better irrigated parts of Asia, notably certain sectors of the Indian sub-continent, as well as Thailand, Indonesia and the Philippines, the Green Revolution has been losing some of its momentum as farmers find they can no longer rely on acceptable-quantity flows of irrigation water for their multiple crops of bumper-harvest rice each year (Cool 1984, Jayal 1984). In the Ganges River system, dry-season water flows have declined by almost one-fifth during the 1970s (Bahugna 1978). Much of India's achievement in attaining food self-sufficiency has been due to a doubling of irrigated area since 1960. Yet, because of disruption of major water flows through deforestation, and surging demand for domestic needs and industry (as well as sheer rise in human numbers), India faces the prospect by 1995 of an acute water shortage in much of its territory (Agarwal and Narain 1985). Despite the exceptional emphasis that must be directed toward irrigation water supplies, however, we find that (as in the case of public health) the superscale agricultural programs directed toward expanded irrigation pay little heed to the ultimate source of many water supplies, namely forested catchments (Gasser 1981).

Within the upstream catchments of developing world rivers live 10 percent of developing world farmers. This small segment of population thereby exercises much influence over the 40 percent of farmers who live in valleylands and floodplains (see Haigh 1982, which is an annotated bibliography with more than 400 items on the issue; also Hamilton 1983, and National Commission on Floods, Government of India 1980). Not only does forest clearing lead to expanded water flows. It aggravates problems of soil erosion, which causes aggradation of stream and river beds, leading in turn to disruptive changes in water courses and thence to increased flooding.

The worst flooding occurs in the Indian sub-continent, and especially in India itself. The floodplains of India's rivers comprise 1.25 million sq. kms., or 38 percent of the country, supporting more than 300 million people. Flood-prone lands have doubled in extent from 20 million hectares in 1970 to 40 million in 1980 (Agarwal and Narain 1985, Dewan and Sharma 1985). In the Ganges Valley alone, the annual value of damage to crops, housing, public utilities and other property now averages more than $1 billion. Conversely, the average annual outlay on flood control works during the same period amounts to less than $250 million; while expenditures on watershed rehabilitation amount to even less.

ASYMMETRY OF EVALUATION

Many of the natural resources in question--notably forests with their hydrological functions, but also soil and water stocks--are not usually priced in the marketplace. So, exceptionally valuable though they often are, they do not send us signals of people's evaluation of them. Conversely, the patterns of misuse and overuse to which they often are subject in order to

generate associated goods such as hardwood timber, supply sensitive signals of their commercial worth. Thus, there arises an asymmetry of evaluation.

Fortunately, and by dint of innovative modes of analysis of these nonmarket outputs, we can come up with "working estimates" of some competing values at stake. True, these proxy modes of analysis may appear crude in comparison with the refined modes of evaluation for conventional goods. Nonetheless, they serve to illuminate a complex situation. In Tanzania, for instance, it has been estimated (Peskin 1984) that deforestation leads to externalities, both environmental and economic, which, while ignored in conventional calculations of GNP, reduce Net National Product by 11 percent per year. Though the approach is less than rigorously scientific, it serves as a first-order approximation of natural resource values at issue.

ULTIMATE SOURCES OF PROBLEMS

The main source of deforestation, to cite a pervasive phenomenon with serious repercussions, is the slash-and-burn farmer. This person accounts for more forest depletion than all other agents put together (FAO and UNEP 1982, Myers 1989). Yet the farmer, in his most widespread manifestation as a shifted cultivator, usually finds himself obliged to engage in his destructive lifestyle by virtue of pressures over which he has little understanding or control--pressures generated by maldistribution of land in established farming areas, scant access to agronomic technology and credit systems, and the like. He is no more to be blamed for felling the forest than a soldier can be held responsible for starting a war.

So we must be careful to distinguish between proximate causes and ultimate causes of deforestation. By extension, the main response to deforestation no longer lies with measures that operate within the forest (nor are foresters the only, or indeed the best, persons to tackle the problem). The main response should generally lie in areas far removed from the forest, for example, encouraging or promoting intensified agriculture that relieves the incentive for otherwise landless farmers to migrate into forests. By far the most productive way for Brazil to stem much of the spontaneous and unsustainable settlement of Amazonia is to engage in land reform in territories in southern parts of the country.

This phenomenon of "marginalization" also occurs with respect to other communities and environments. In parts of Central America and the Andes, an array of socioeconomic and political factors cause smallscale farmers to become sidelined from the development process, whereupon they are compelled to move out from the better farmlands and up onto steeply-sloped terrain, where they cause much soil erosion (Blaikie 1985, Posner and McPherson 1982). In many other developing-world areas, too, marginal people are pushed into marginal environments where they unavoidably impose much injury on natural resources, notably land and water supplies. By virtue of their impoverished status they tend to be people who are unusually vulnerable to externality effects of both environmental systems and socioeconomic systems; and by virtue of their rudimentary agricultural practices, they are unusually inclined to damage those environments that are unusually vulnerable to misuse anyway.

NONTIMBER VALUES

Tropical forests are often perceived as natural resources that lack much value beyond standing stocks of wood. The well-known 1982 report by FAO, *Tropical Forest Resources*, concentrates largely on the forests as sources of commercial timber and fuelwood, while their other goods are almost entirely left out of account. Yet tropical forests supply many other products, sometimes known as nonwood products. Equally important, they provide many environmental services, in the way of soil protection, regulation of hydrological systems and the like. As noted above, many of these further outputs manifest themselves in relation to other resources, notably land and water; and they function in relation to several development sectors in addition to forestry, notably agriculture and energy. Yet despite the sizeable value of the entire range of the forests' outputs other than wood, these additional benefits are frequently not appreciated until the forests have been degraded if not destroyed. A synoptic summary of all goods and services available from tropical forests is presented in Figure 1, which shows plainly that wood products make up only a small part of the full spectrum of benefits to be derived.

Among notable nonwood products are many harvestable items other than timber and fuelwood. These range from damar, sandalwood, resins, kopal and several essential oils and edible oils, to fruits and nuts, fibers and canes, natural silk, and exudates. Also, and at least as important, are genetic resources. All these nonwood products can be harvested with virtually no disturbance of forest ecosystems.

Ironically, these diverse products are often known as minor forest products. Yet they turn out to be not so minor when we consider their variety and value (Lasschuit and van Eerd 1983). Peninsular Malaysia's forests contain at least 1250 nontimber plant species of use to humans, or roughly one in six of all species (Jacobs 1982). This total, moreover, does not include many additional food plants that are gathered from the forest in small quantities; nor does it include all medicines; and it includes only a few items from several other major categories. So the true proportion could be as high as one plant species in three. Making an approximate extrapolation based on the one-in-six estimate above (albeit derived from a very meager data base), one finds that some 15,000 plant species in tropical forests could well offer potential for material goods.

What are some of the economic values involved? Rattan exports from Indonesia are now worth some $90 million per year (Cornelius 1984). Rattans, being tough, climbing palms, are in a sense woody materials, but they are included here since they are not generally classified by foresters as timber products. In 1981 Indonesia's exports of patchouli oil were earning around $12 million a year, and of related oils more than $25 million (Tcheknavorian-Asenbauer and Wijesekera 1982). Together with exudates and sundry other products, totaling 80,000 tons in all, Indonesia's nonwood products brought in foreign exchange totaling around $200 million in 1982, up from $28 million in 1973 (Gillis 1986). True, Indonesia's nonwood products are better developed than those of most tropical forest countries, and to this extent the data may not be characteristic of other countries. But they reveal the potential that awaits methodical development. Moreover these figures reflect only a crude minimum calculation of total revenues. They compare with export earnings from wood products of $583 million in 1973 and $899 million in 1982 (Gillis 1986).

Ecological effects	Catchment protection	Controlled runoff, water supplies, irrigation, soil fertility, oxygen
	Ecology and wildlife conservation	Recreation, tourism, national parks, protection of endangered species of flora and fauna
	Soil erosion control	Windbreaks, shelterbelts, dune fixation, reclamation of eroded lands
Indigenous consumption	Fuelwood and charcoal	Cooking, heating, and household uses
	Agricultural uses	Shifting cultivation, forest grazing, nitrogen fixation, mulches, fruits and nuts
	Building poles	Housing, buildings, construction, fencing, furniture
	Pit sawing and sawmilling	Joinery, furniture, construction, farm buildings
	Weaving materials	Ropes and string, baskets, furniture, furnishings
	Sericulture, apiculture, ericulture	Silk, honey, wax, lac
	Special woods and ashes	Carving, incense, chemicals, glassmaking
Industrial uses	Gums, resins and oils	Naval stores, tannin, turpentine, distillates, resin, essential oils
	Charcoal	Reduction agent for steelmaking, chemicals, polyvinyl chloride (PVC), dry cells
	Poles	Transmission poles, pitprops
	Sawlogs	Lumber, joinery, furniture, packing, shipbuilding, mining, construction, sleepers
	Veneer logs	Plywood, veneer, furniture, containers, construction
	Pulpwood	Newsprint, paperboard, printing and writing paper, containers, packaging, dissolving pulp, distillates, textiles and clothing
	Residues	Particleboard, fiberboard, wastepaper

Figure 1. Spectrum of goods and services available from tropical moist forests (adapted from World Bank 1978).

For a more extensive and systematized assessment, consider the case of India. In 1977 total net revenues accruing to the government from the forestry sector, including many sources apart from commercial timber, amounted to $336 million (Gupta and Guleria 1982). Of this total, nonwood forest products accounted for $134 million, or 40 percent (and their share of forestry exports, 63 percent). Since an estimated three-fifths of all nonwood forest products are consumed on the spot by local people, they do not enter the cash economy, and hence are not incorporated into national accounting figures. So a realistic figure for the value of these products probably exceeds $200 million. Among leading categories in 1977 were medicinals, drugs, and pharmaceuticals, worth $38.4 million; lac and lac products, $19.8 million; gums, resins and balsams, $14.6 million; bamboos, $6.8 million; and essential oils, $5.9 million.

Equally important, the rate of growth in revenues from India's nonwood products during the period 1970-77 amounted to 15.6 percent per year, way ahead of that for commercial timber. In addition, nonwood products were generating much employment, more than 70 percent of the 2.3 million man-years in the forestry sector overall. The true figure for employment, including those man-years not counted by official surveys, can be roughly estimated at as many as 4 million.

It is the social as well as economic values enshrined in employment that points up some salient contributions of tropical forests to the overall cause of sustainable development. Forestry as traditionally practiced in the form of commercial logging tends to be a capital-intensive affair--whereas, by contrast, renewable harvesting of nonwood products is much more of a labor-intensive exercise.

SUMMARY AND CONCLUSION

The analysis above prompts several conclusions:

1. The environmental interconnections of tropical-forest ecosystems constitute an "objective reality" that, whatever its compelling character, is often in conflict with the compartmentalized approach of human institutions. As more people make greater demands on the forestry-resource base that ultimately sustains much economic activity in the Third World, and as developing economies become increasingly complex and integrated, we can expect these conflicts to become more numerous, more complex and more acute.

2. In response, we need to adopt a more integrative approach to forestry-resource issues. We have all too little understanding of the many environmental interactions at work, which places a premium on urgent research to clarify the issues, as well as on monitoring the depletive processes that undermine the very basis of sustainable development.

3. Nonetheless, we possess enough of a grasp of the situation to allow us to do much more than hitherto. The key to the challenge is to engage in more "rough and ready" appraisals by drawing on such information and comprehension as is already available: how much deforestation (together with associated degradation in the form

of soil erosion) is already underway, and with what consequences for associated resource stocks and for dependent economic sectors. In other words, we must work better with common-sense judgements, deficient as may be the data base on which they are founded. What is wanted above all is enhanced perception of the situation, of its processes and of its root causes.

4. Having come to grips in principle with the challenge, we need to formulate systematic modes of analysis to enable us to confront the tradeoffs at issue. To date we have all too little idea about how to identify the tradeoffs, let alone to define them, to document them, or to evaluate them. Moreover, while environmental safeguards can be expensive, they should be matched against the positive payoffs, which can be still more substantial. Similarly, while the costs of action can be high, they need to be measured against the concealed costs of inaction.

The outcome will be that we face many difficult choices. How much tree planting versus how much food production (insofar as the two are actually opposed)? How much watershed management, notably through reforestation and afforestation, undertaken by upstream communities, versus how much benefit for (generally much larger) communities downstream?

However perplexing the choices are for decision makers (development planners, political leaders, policy makers), let us bear in mind that choices are meanwhile being made. They are being made daily, with broadscale impact, albeit with limited cognizance of all factors involved. They are being made by millions of slash-and-burn cultivators and others who take their decisions by force of circumstances. If implicit micro-choices are already being made, let us have them complemented by macro-choices made explicitly: **by design rather than default.**

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