Sustaining Tomorrow

A STRATEGY FOR WORLD CONSERVATION AND DEVELOPMENT

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Sustainable Use of Species and Ecosystems

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For the sake of honesty, I should warn you that I will be rather biased, talking about things I know (or believe I know) and leaving aside matters that may be very important but are outside my direct experience. I may also hurt your sensibilities at times by using some words that upset conservationists. I want to present conservation and the sustainable utilization of species and ecosystems as nothing less than powerful tools for development. I know that *development* is a bad word in some places, but it certainly is not, or not yet, in many of the tropical countries that will be the main focus of this chapter. In those countries, if we want to get support for certain types of conservation actions, they must be based on the development of communities, on improvement of rural or city life. Whatever the program chosen or the strategy pursued, it must include the idea of development.

When we speak about sustainable utilization of species and ecosystems, one essential concept must be analyzed, understood, and applied—*carrying capacity*. The idea of carrying capacity implies that ecosystems can tolerate a certain amount of intervention under normal conditions. This can be removal of individuals of a species or other types of exploitation. Beyond that amount of exploitation there is degradation, no more recuperation, and, of course, no more sustainable utilization. I am sure you are all familiar with this basic concept, so I will focus primarily on its application.

Short-Term versus Long-Term Perspectives

Let us look at resource management from an economic perspective. There are many ways of approaching the economics of sustainable utilization. For instance, Sidney Holt has pointed out that it makes perfect economic sense to exterminate the whales. When you harvest them (a euphemism for cruelly killing them), sell their products, and make a large profit, you then can invest that profit with interest and make more money than if you keep harvesting the whales on a sustained yield basis. From a strictly economic point of view, based on a simple cost-benefit analysis, one may argue that this is the most "efficient" way of dealing with resources.

But if you begin assessing many of the other aspects of the whale slaughter—environmental stress, loss of an irreplaceable resource, loss of educational opportunities, as well as scientific, aesthetic, and ethical values—then the loss can be considerable. Of course many of these values cannot be evaluated easily, but we know that they exist and are worth something. Naturally, these values change according to cultural factors and other variables. Nevertheless, their total is much greater than the strict value of marketable products.

For some people—and they number hundreds of millions—the economics of profit means little, often nothing. Ultimately what is at stake for them is their own survival. I refer to the millions of poor farmers who cut the forest or hunt to extinction to feed their families. They are humans like us, who only want to avoid starvation. How can we convince them to worry about plant or animal species when they themselves must fight for survival? This is just another—albeit terrifying—ethical consideration we have to take into account when we speak about sustainable utilization.

If I were pressed to explain why there is so little concern for sustained use and for the concept of carrying capacity throughout the world today, I would have to blame it on a lack of understanding of fundamental ethics. Of course these ethics need to be adapted to each culture and community, but has this ever been attempted? Quite the contrary, in many places the ethical standards work against the concept of sustainable utilization. Indifference or reactions such as "Let us make a quick profit . . . now" or "*après moi le déluge*" are extremely widespread (even when not stated quite so bluntly). The destructive fishing by highly sophisticated ships from industrial countries along the coastal waters of many developing nations provides an excellent example. The fishermen are pressured to harvest as quickly, as efficiently, and in the greatest quantities possible because if they do not, someone else will. There is no question of sustained utilization. The "cut-and-get-out" practices of many tropical timber exploitation groups show the same lack of regard for anything other than short-term profit.

Finally, we must consider our priorities as part of human society. Usually we think, Country first, and What can I do for my country? But is this really justified? Why are we not educated to think of planet earth first? Should we not be looking at the earth as the first and most primordial element in our moral obligations? If the answer is yes, then it is easy to transfer the concepts of carrying capacity, and eventually sustainable utilization, to a global scale.

Yet another ethical problem has really been compounded by existing educational systems. Mankind is the custodian of a heritage of a great genetic diversity, but this idea has seldom been incorporated into our ethical education. The same applies to other credos of environmental ethics, such as the promotion of diversity—and I mean not only physical or biological diversity, but cultural diversity as well. Ecological ideas definitely argue against today's tendencies toward cultural homogeneity or, even worse, the open imposition of one culture upon another. They provide a counterforce to the trend toward cultural domination. We know of many cultures that had definite ethical standards concerning the utilization of resources. Most "primitive" cultures hunt only for their direct needs. But their standards have often been broken down by the arrival of "advanced" cultures, which make economic profit a much more powerful motivation. As these new ideas are accepted, former ethical standards are destroyed. We have watched

this happen to the American Indians and to other cultures in a variety of places.

Perhaps the most important ethical consideration about natural resources applies to decision making, particularly when it affects our future. When we are choosing among several possibilities for managing resources, we must examine the ethical foundation for our choices. The logical and ethical decision will be the one that favors long-term sustainable utilization. Even more, one could argue that in case of doubt the best decision is the one that keeps options open and transfers decision making to future generations. Do we see these concepts as part of resource management today? No, in fact we see a tendency to the contrary. Our future options are diminished by opening up virgin lands, destroying natural diversity, causing extinctions, and increasing the homogeneity of landscapes. Naturally these are not the avowed reasons for the decisions we make, but they lead to the same results.

Examples from Tropical Rain Forests

Having defined some important problems in the abstract, I would like to present a few case studies that illustrate my concerns. I am most familiar with sustainable utilization of tropical forests, which are complex ecosystems that are being rapidly depleted. Tropical forests are more than simple forests; they constitute a series of systems that have great impact on the lives of many people, both those who live nearby and others who are far removed.

Recently studies have calculated the loss of tropical forests to be between 10 million and 20 million hectares per year, approximately 25 to 50 million acres. Analyses are complicated by discussion of how much area reverts to secondary forest or stays as pasture, and so on. But whatever the data, everyone agrees there is an incredibly high rate of tropical forest loss. Table 5.1 outlines projected tropical rain forest depletion in the regions where rates of destruction are greatest. Its figures are based on a study prepared for the timber industry, so they reflect concern only for that industry's use of the forests and not for other uses (including maintenance of genetic diversity) or the impacts of logging on those uses. Despite this limited frame of reference, however, the study is valuable as the most recent analysis of tropical rain forest loss and the only one to permit a relatively reliable regional breakdown.

FIG. 5.1. *A cloud forest in the Arenal reserve. This watershed supplies Costa Rica's largest dam. At 1,200 meters clouds sift through the trees and coalesce to form droplets that feed local streams and, through them, the whole watershed. Photograph by author.*

It is quite evident that within less than two generations no more tropical rain forests will exist, except for a few national parks and other protected areas. Obviously, there is no question of sustainable utilization of these forests. They are simply being destroyed—cut down and burnt. What is worse, the utilization following removal of the forest is seldom sustained. Why this senseless destruction?

The problem will not be easy to solve. Tropical forests, I have to confess, are not easy to manage. At present, there is not a single documented case throughout the tropical world—in the Americas, Africa, or Southeast Asia—where the mixed tropi-

TABLE 5.1. *Projected Loss of Priority Tropical Forests, 1975–2000*

	Total Closed Forests*		"Operable" Hardwood Forests†	
	area 1,000 (hectares)	% of 1975 area	area 1,000 (hectares)	% of 1975 area
West Africa	6,600	47.1	6,600	54.7
Centrally-planned tropical Asia	6,300	29.1	6,000	35.3
South Asia	16,400	23.0	13,600	27.9
East Africa and islands	3,300	17.8	3,200	50.4
Insular Southeast Asia	21,600	16.5	20,000	26.3
Central America	10,900	13.4	4,600	23.9
Tropical South America	64,200	12.0	57,300	13.3
Continental Southeast Asia	4,100	10.6	4,000	13.3

SOURCE: IUCN, with UNEP and WWF. (1980) *World Conservation Strategy: Living Resources for Sustainable Development.* Gland, Switzerland: IUCN/WWF; Nairobi: UNEP.

*Closed forests include logged-over forests "as long as they are not alienated from non-forestry purposes."

†"Operable" forests exclude protected forests (parks, wildlife reserves, and so on); forests on terrain that is too steep or wet to exploit; and forests, such as most mangroves, "permanently without industrial wood potential."

cal rain forest has been managed for timber production on a sustainable basis for a reasonable amount of time. There are, of course, theories about how this could be done, but no one has implemented them successfully. Although we speak constantly of exploiting the tropical rain forest "rationally," no one has yet been able to achieve sustainable utilization. I should make clear that certain types of tropical forests can, of course, be managed rationally, with a profit, and on a sustained yield. But these are not the immense tracts of mixed primary rain forests.

Moreover, cutting wood from the tropical forests is not the principal cause of their destruction by far. In Latin America millions of hectares are being cut every year to create pastures with low carrying capacity. Grazing is managed on a very land-intensive, low-labor basis. There is often only one head of cattle for every 5 or 10 acres of land. The grass-fed cattle produce lean meat, which is exported, mostly to the United States, European countries, and a few meat-hungry countries in Latin America who can pay the price, such as Venezuela and Mexico. The worst part of this problem is not so much that the forests are converted to pastures but rather that after a few years, in rainy areas particularly, many of the pastures thus created do not sustain themselves; they eventually revert to secondary brushlands or forests of very little value. In other words, the forest has been destroyed, the grass has been used for cattle for perhaps ten to fifteen years, and the area has been abandoned. Then the process is repeated on the next tract of forest. This is the fate of very large forest surfaces throughout Latin America and, more recently, other tropical areas.

In U.S. inquiries about these practices, it was learned that the lean beef from tropical countries is being mixed with meat from grain-fed beef (which has a high amount of fat) to meet the minimum standards for fat in the hamburger industry. Some of the largest cattle ranches exporting beef from Latin America to the U.S. hamburger industry belong to major U.S. meat-packing corporations.

The wood chip industry, also supplied by the tropical rain forests, is another major ecological threat. Very large companies based in Japan and a few other countries, including the United States, are particularly eager to harvest enormous quantities of chips and reconstruct them into compressed or hard boards. They are willing to pay nearly any price—including "under the table" pay-

ments to key decision makers. Chip harvesting can hardly claim to favor sustained yield. In their own countries many companies are extremely good custodians of forest resources, and they eagerly practice sustained yield; they often apply strict conservation measures and take special care to replant trees and promote conservation education. Unfortunately, they are not as anxious to be good land stewards in developing tropical countries.

There have, of course, been other reasons for destruction as well: breaking down of traditional land use practices, adoption of new devastating ways to harvest timber, and use of heavy soil-compacting machinery. In many places we know indigenous communities have been using the forest for centuries, yet it is still relatively intact. New technologies, economic ways of looking at (and exporting) resources, and sometimes destructive governmental interference—such as huge colonization schemes with populations totally alien to local cultures—have brought havoc to both people and their resources. In the tropics this new resource utilization has reached and passed critical thresholds beyond which the land loses its capability.

The land is being stripped of its productivity. But at the same time, the new population that I mentioned needs to continue feeding itself, and it can only do this by cutting down more areas of forests, including lands clearly marginal for sustained cropping. Some of the most blatant examples of this are along the Trans-Amazonian Highway. Peasants throughout Latin America have been relocated to new settlements in the forest. They have not come near the planned goal of making a permanent living from the land. Politically, it is extremely expedient to relocate land-hungry farmers. For politicians who are in office only a short time, it is a glorious moment when, with all the news media present, they distribute plots to farmers and award them property titles. For the farmers there is some initial hope, but ultimate disaster. They cannot make a permanent living from these marginal lands, regardless of ownership. The lands usually have poor soils or they are too wet, too dry, or too steep for farming. Let us not be fooled—there are no more large tracts of good agricultural land left unused anywhere in the world. The amount of land that will produce a sustainable harvest is extremely limited, and it is already in use.

Possible Solutions

Enough lamenting. Let us now search for some solutions. The first thing to consider is the interdependence of all the inhabitants of planet earth. This is not something on which I will elaborate. It should be clear in developed countries such as the United States, which import a very large amount of their resources from the rest of the world. A U.S. citizen uses 500 times more water per day than a citizen from an African country. But the U.S. citizen also uses many times more energy, minerals, and other resources that do not come from his own country.

You may argue that this favors trade; buying raw materials such as timber, chips, or beef from another country helps that country obtain currency to meet its balance of trade. True enough. But will it last? Does this system provide a sustainable yield? And who within the exporting country gets most of the benefit? What is the United States, or any other of the receiving countries, doing to assure—for its own sake and the sake of the exporting countries—that this exchange of resources for money is based on long-term priorities? At present, the ability to sustain trade is simply not a major consideration. It is not really necessary to trace the blame. Neither the importing nor the exporting countries give this matter much thought.

Renewable resources can and should be managed for sustained yield. The richer nations have a stake in assuring that the trade in vital raw materials will be maintained on a permanent basis. But this idea is largely ignored in commercial decision-making processes, assistance policies, and many current banking or financing schemes. At best we see policies of conditional involvement in remedial action. Of course, there are two schools of thought about international involvement: one advocates nonintervention and the other argues for greater efforts. It is not for me to judge when active involvement becomes intervention in the internal affairs of another country. But certainly neither isolation nor

business as usual can be justified. Let me say it another way: In a shrinking world—shrinking in terms of the available stocks of natural resources—we cannot afford to project the past indefinitely into the present. Again, the concept of critical thresholds is central. There surely are ways of demonstrating the need for new policies. Unfortunately, however, I do not see governments making any great efforts to reverse present trends.

Foreign assistance and cooperation, the "compensation" to help poorer countries protect their natural ecosystems and resources, provide examples of possible solutions and their difficulties. The Brazilians were very upset some years ago when scientists insisted that they should not cut the forests along most of the Amazon. It is "our country" they claimed, and "it is our sacred right to develop the Amazon as we see fit. We do not accept any interference." But I think that time has passed. The Brazilians themselves now know the problems with Amazonian development. Of course they still do not want interference, but they certainly would like to receive support, particularly in scientific and educational areas. Smaller and poorer countries need such assistance desperately. They need to know how to study, to plan, to understand how their ecosystems function, and to manage their resources. Good management sometimes means protection, in most cases it means wise use. Even sustained yield does not necessarily mean direct exploitation. A national park, for instance, is land that can be managed on a sustained yield. It produces educational, scientific, ethical, and other values as well as products such as water and wildlife. We must also encourage certain aspects of traditional life-styles as ways of managing resources. These traditional systems do not deplete resources. Unfortunately, we have been led to believe that new technological advances can solve all problems.

Some international organizations are promoting this new kind of cooperation, but their work has been too limited. It is unfair to request that a poor, undeveloped country build a representative system of national parks, biosphere reserves, and other protected areas without outside assistance. After all, who are the main users of parks and reserves in tropical countries? More often than not they are people from richer countries and only the wealthier segments of the local population.

There is still another possibility for cooperation between richer and poorer countries: joining forces to promote national conservation strategies. I was in Venezuela some months ago to contribute to a publication entitled "Presentation of the World Conservation Strategy: The Case of Venezuela." This document, based on the World Conservation Strategy, can easily be adapted to other countries and conditions. The implementation of both national and international strategies deserves worldwide support. At present, only some forty of the 160 or so countries have published reasonable conservation strategies for themselves. The effort of unifying the implementation of these strategies with implementation of the world strategy—remember "Only One Earth," the unofficial motto of the 1972 Stockholm conference—remains virtually untried. We must pay much more attention to implementing unified conservation plans.

How can we approach the biggest environmental problems, such as relieving the pressure on tropical forests? There is obviously no simple solution, particularly if the human population is continuously expanding. However, certain rules or guidelines can help.

The first of these guidelines is better utilization of the areas with high potential productivity that have already been opened. In tropical regions, these would be lands that are not forested and already have some infrastructure. It is incredible that places with fertile soils in Colombia, Venezuela, Mexico, or Costa Rica are being used as extensive, low-yield animal husbandry estates that produce beef primarily for export. Even though the yields per unit of surface are low, the landowners make a good profit because of the size of their ranches. With better management techniques the same land could produce ten, perhaps fifty, times as much food. Instead of being a source of beef for export, it could sustain local families. However, this may not favor the interests of the landowner, and under the prevailing political system it is almost impossible to change land use patterns. The landowners have a perfect right to use the land as they do under the present constitution. But something is wrong with

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a system that allows a person not to make the most of this land on a sustained yield basis when there are scores of hungry people in the same region. Admittedly, this is a simplistic analysis of a complicated problem affecting basic rights. Nevertheless, it is quite clear that if some of the best agricultural land in these countries was properly used, there would be absolutely no need for encroaching on marginal land, which cannot be managed for sustainable yield. Eventually, with population relentlessly growing, some long-term alternatives involving proper carrying capacity must be sought.

Deforestation is closely linked with pressures on land use. Eventually, we must manage all land so that it produces its maximum sustainable yield. Marginal land should be left largely untouched. Yet today almost half of exploited tropical land is marginal and is condemned to be destroyed. When it is lost we will also lose the wild animals and plant species that it harbors. These species themselves would have been the sources of new food and medicines. In some cases pressure on marginal forestlands can be relieved by carefully designed forest plantation programs. Needless to say, these should never be established at the expense of natural forests. But on degraded lands, such as the ones resulting from abandoned pastures, they can be quite beneficial. We urgently need some imaginative investment schemes by capital-rich countries to promote these plantations and to help poorer countries build industry based on their products. They could also supply timber and fuel wood for local needs. I repeat: Plantations should never be started at the expense of the original forest. They should be developed on land that has already been stripped of its original forest cover and is often subject to erosion in its present state.

Trees that fix nitrogen from the air through bacteria associated with their roots could be planted on a large scale and become the basis of a series of industries. They would simultaneously produce charcoal or firewood as well as stop erosion and rehabilitate the soil. This need for firewood is becoming a critical problem in many places. There are also possibilities such as agro-forests, in which trees are interplanted with food crops. All these ideas need to be explored.

FIG. 5.2. *One of many landslides in Costa Rica planted with cuttings of Itabo,* Yucca elephantipes. *This species holds the soil and develops into small trees which produce edible flowers and cuttings that can be exported as ornamentals or used for additional plantings. Photograph by author.*

If we want to institute sustained yield, we must promote long-term conservation policies for land use and management. There must be guidelines for decision makers based on scientific, ethical, and other cultural considerations. Of course, there is also a place for economic analysis, but it must be carefully weighed for short- and long-term goals and include all the direct and indirect, or intangible, benefits. And there must be an underlying sensitivity to basic ecological concepts. Political and economic land use decisions must be based on ecological considerations, not the other way around. We must strengthen sensible technical cooperation programs, be they multilateral, bilateral, governmental, or nongovernmental. I realize that the meaning of the word *sensible* can be anyone's guess, but these programs should not be based strictly on the sponsor's political or economic needs. They

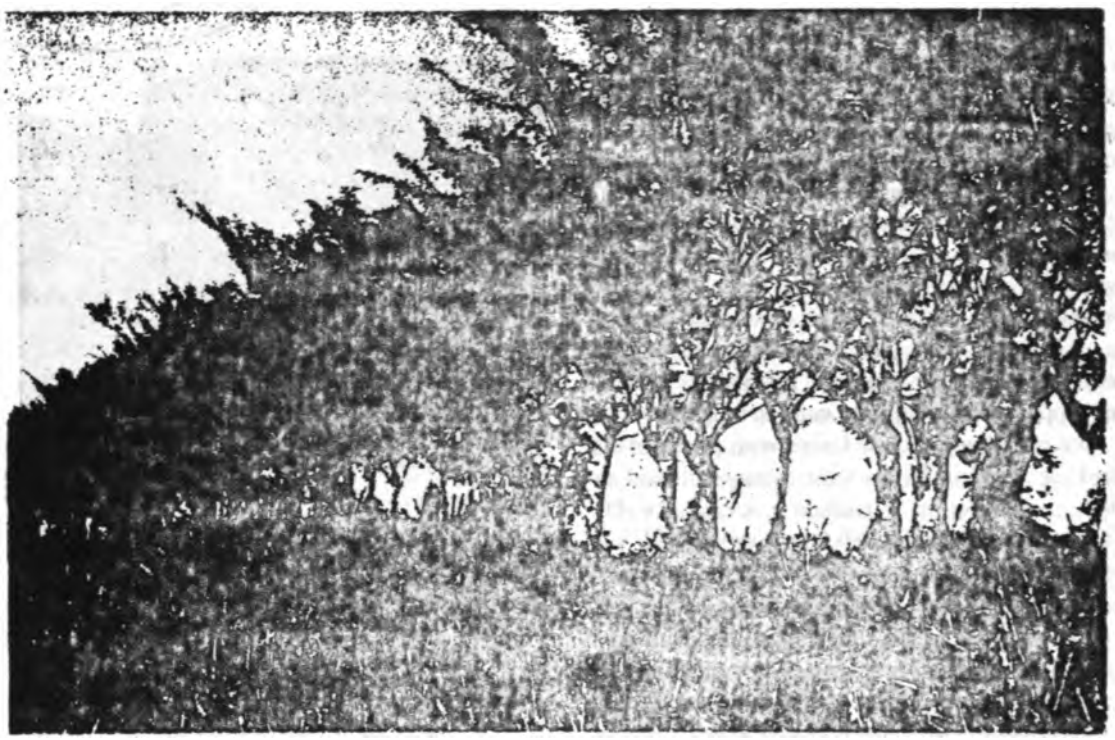

FIG. 5.3. *A live fence of* Guachipilin, Diphysa robinicides, *in Costa Rica. The wood of these trees is valuable for building, their roots fix nitrogen, loppings produce biomass for soil enrichment, and the branches are good fuel. Scientists, however, know practically nothing about the ways local landowners cultivate it. Photograph by author.*

must pay much more attention to sustainable yield, carrying capacity, long-term objectives, and, above all, building of local leadership. It is also essential to strengthen educational programs and local research facilities. The conservation of natural areas in developing countries should be a genuine worldwide concern. These areas promote the welfare not only of our towns, our provinces, and our countries, but simply of planet earth, our home.

Discussion

QUESTION. Do the methods of cultivation you are studying expand on local practices or make basic changes?

ANSWER. For the most part, they expand on local practices. For example, the leguminous tree Gauchipilin is extremely fast growing and produces a lot of nitrogen. Local people plant it because they say it makes the soil "more fatty"—it increases the fertility of the soil. The interesting thing is that these local farmers have been using it for years to improve their soil. Our duty as scientists was to understand why they planted it and how the system works. After studying their methods, I can say that they work very well indeed. This is one of the trees that has been brought to Thailand as a replacement for the poppy cultures to make the soil productive for sustained yield farming.

QUESTION. Are the methods that you described solely an approach to helping subsistence farmers—which is a valuable enterprise in itself—or are they likely to become even more widespread?

ANSWER. There will be fundamental changes in agricultural methods in the future. What they will

be is anyone's guess. We need hard thinking about how agriculture will evolve in the next years. But one thing is certain; agriculture will not be what it is now—high input, high everything. You cannot long afford to live if you use 10 to 15 calories of energy to produce 1 calorie of food. It will simply not be possible. The Chinese farmers are producing 1 calorie of rice with 0.05 calorie of input. American farmers do it the other way around. Something will crack under the strain of such energy use. The agriculture of the future will favor solutions that save as much energy as possible.

The concept of carrying capacity is also one we should dwell on. Ultimately, the carrying capacity of the land around us will determine how long we survive as a species. There are indications that we have already exceeded our carrying capacity, or at least that we are on the edge of it. We can get away with this for a while because the results will not manifest themselves right away. But we will pay the price if the human population continues growing.

Contrast this approach with the economic one. There is a theory which states that in the long run the dollar will prevail over all else. The pendulum of public opinion sometimes swings toward protecting natural resources at all costs; at others it swings back toward the dollar. Right now it is swinging back to short-term economies. But we will have to think in terms of long term survival as a society.

QUESTION. How have you been able to motivate people to accept these new ideas? Do you use government policy, education, or some other strategy? It seems to me that the hardest step is not discovering better techniques, but getting people to adopt them.

ANSWER. We capitalize on the experience of other countries. Brazil has plantations almost half the size of Massachusetts. They have one of the largest wood and pulp exporting industries in the world based strictly on these plantations. How did Brazil do it? They have a law that allows landowners a tax deduction of up to $1,200 per hectare of disturbed land that has been planted again. These tax incentives have also been used in other countries. Another stimulus comes from an American company, the Scott Paper Company. It gives farmers nursery plants and assists them with cultivation in the understanding that they must sell the crop to Scott. The cropping is done after eight to ten years and sold at the normal price. There is a common interest here between the company and the small farmers.

With the eucalyptus, it was also the small farmers who saw a chance to better their condition. A local farmer began planting eucalyptus not for economic reasons, but because he liked trees. As a result he is now making money. He does not quite believe it yet. A new idea must be demonstrated successfully to get others interested. That farmer is making money and others are asking how.

The basic idea of live fence posts is very old. They have been planted for hundreds of years but never investigated by scientists. It was always considered a poor man's fancy: Because they could not afford stone or some other material they stuck in live branches. Now suddenly we are discovering live fence posts. I have the suspicion that the few scientists who knew about live fences never really believed that farmers could develop such a good idea by themselves. But we have come a long way. We now feel that the farmers have much to teach us. Rather than transferring techniques from outside and having the farmers refuse to adopt them, we begin with their own systems, make improvements, and demonstrate the benefits. They can see the results for themselves.

QUESTION. What percentage of farms with multicropping are operated by small farmers?

ANSWER. The answer depends on the crop. Ninety-nine percent of all coffee and 100% of cocoa is part of a multicrop system. The remaining 1% of coffee is grown by very rich farmers who were very impressed with the high yields of monocultural stands before they understood that you have to make extremely high investments to maintain them.

Farmers, and not just the wealthy ones, use the multicropping system for many reasons: It is a protective device against excessive rainfall, and it also brings nutrients up from the deeper soil. If you apply fertilizer in a multicropping system, the fertilizer goes a long way, not only to the crops but also to the trees, which bring it right back to the surface of the soil. Another major factor is psychological. No farmer wants to depend on one crop. He needs something else to fall back on. If a rich farmer loses all his crop, he goes to the bank and gets a loan. The poor farmer cannot do this, so he develops a system that has many component crops. Then, even if one fails, he does not perish.

We are just discovering these reasons for multicropping. We have been misled by technologies transferred from other countries, which are not adaptable to the ecological and socioeconomic conditions of the local inhabitants. Our whole strategy now is first to learn how the local farmers operate. Then we see how the system can be improved.

QUESTION. There are large corporations and small landlords buying property, cutting down the trees, sawing them, and then leaving the land after it is depleted. It seems to me that countries where this is happening have to understand what is going on and legislate against it. You say countries need our help to do this. How can we help?

ANSWER. First, we must help them understand the issue. Schools are poorly staffed and equipped and people cannot travel. Rather than doing the work directly, we must help these countries develop the skills they need.

You can lobby the decision makers in your country. If there is more awareness in each country about the process of decision making, many of the people at the tops of governments will not be able to get away with the mistakes they have been making. For example, we need help to build up initial money and expertise so that local conservation organizations can have access to small libraries and consultants on issues such as deforestation. Very few local people know much about how to prevent this problem. They have never had the chance to be told, to be given examples of the sorts of problems that can arise.

Another thing we can do is relieve the pressure that causes deforestation. For example, the cattle industry is promoting deforestation in a criminal way. This is not because of the nature of the industry itself, but rather the way it is practiced now. It would be possible to breed cattle on a sustained yield basis, using some of the areas that are fully managed. It would also be possible to create forests that can maintain themselves while producing a sustained yield of timber. We can help countries strengthen themselves and at the same time relieve the pressure on the natural resources demanded by developed countries that leads to destruction.

COMMENT. When I was listening to you talk about the destruction of tropical rain forests, I thought about the resources we have here in Massachusetts that we are "mining" the same way—throwing away rather than husbanding. There are two main ones, and there has been a different resolution to the management of each.

The first are the salt marshes on the coast. We have about 40,000 acres of these left. They are the remnants of a system that was much larger at one time. We now have some fairly protective legislation that keeps people from altering and dredging them. But the legislation has not been there for very long, and the coastal management program of which it is a part is really the remainder of a grand scheme that fell apart—we tried to develop some broad land use legislation in the United States. The only portion that did pass Congress was the coastal part. I think that happened because there was a lot of good information being generated at our universities on salt marshes and coastal land.

The other resource is agricultural land. It is coming to be seen as a more valuable resource as increasing fuel prices make us realize that importing a large amount of our food makes us very vulnerable to rising transportation costs. We are trying to develop a protective system for our agricultural land. But it has been very difficult to do this because we have to change people's perceptions of the relative values of different land uses.