



ANNEX 10

TO MINUTES OF THE SAO PAULO MEETING

MOIST TROPICAL FORESTS  
(WCED/85/25)

WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT

FOURTH MEETING  
Sao Paulo Brazil  
25 October - 4 November 1985

WCED/85/25

To: All Members of the World Commission on  
Environment and Development

From: Secretary General

Re: Moist Tropical Forests

During discussions in Oslo with Commissioners, it was agreed that Professor Marc Dourojeanni should be requested to prepare a draft policy paper on Moist Tropical Forests viewing the issue from a global rather than a single country perspective. Professor Dourojeanni agreed to do so, and I am enclosing a copy of his paper draft for discussion in Sao Paulo.

Professor Dourojeanni will be present during the discussion in Sao Paulo, and following the meeting he will prepare a further draft taking into account your observations and directions. The focus in the paper is now on Latin America, as you will see, and he is particularly anxious to ensure that the situation in the Asian and African tropical forests is properly reflected in the paper. It had been hoped that time would permit Professor Dourojeanni to obtain comments from Commissioners de Botero, Nogueira-Neto, Salim and Shaib and to reflect them in the paper prior to its circulation, but unfortunately this proved impossible.

Prior to the discussion of this paper, the Commission will have been exposed to several presentations on Tropical Forests at the Public Hearings. This includes a major submission to the Commission by the World Resources Institute on a World Forestry Plan of Action that has been prepared in cooperation with the UNDP, World Bank, IUCN and others.

Action Required: Discussion and Direction

October 8, 1985

WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT

TROPICAL FORESTS

A policy ideas paper prepared  
by Marc J. Dourojeanni on the  
basis of the document  
"Tropical Forest and its  
Conservation by the Year Two  
Thousand: Priorities for  
Today and Tomorrow",  
presented at the 16th IUCN  
Technical Meeting held in  
Madrid, Spain (November 3-15,  
1984)

September 1985

TROPICAL FORESTS

ABSTRACT

The paper deals with the major issues that need to be addressed to achieve a desirable scenario for development - mainly rural - in the humid tropics of the world. Such a scenario is assessed briefly, on the basis of a short review of today's most conflicting concepts of the tropical forests and their future as well as of the actions currently underway at the international level. The main part of the paper introduces the elements of a programme to realize the desirable scenario. Some elements are clearly political (national agrarian policies, land ownership, more intensive use of the land versus new settlements, regional development outside humid tropics, national defence, industrial crops, integral and integrated rural development) whilst others are more technical (land potentials, transport, priority for permanent crops, policulture, intensive small scale cattle farming, soil conservation, agro-forestry, management of forest fallow, reforestation, forest management, avoidance of wood losses, wildlife management, protected areas, fishery, tourism, mining and oil exploitation, industry). Other necessary elements are also discussed.

## 1. INTRODUCTION

It is probably not possible to demonstrate that tropical forests are more endangered nor even more important for mankind's future than other biomes. Nevertheless, there are no doubts about their significance as one of the last great frontiers for development, now under enormous pressure. Nor are there any doubts about their being the world's largest reservoir of mostly unknown biological diversity and of slightly better recognized genetic resources. Thus, of their utilization, while maintaining the function of their natural cycles and processes and conserving their biota, is becoming one of the most difficult and stressful issues of our day. The challenge is to practice sustainable development under present and foreseeable social and economic conditions.

## 2. THE PROBLEM

The tropical forest problematique is not new at all and is essentially simple. Millions of landless and poor rural families are occupying, misusing and under-using the most obviously available lands in an anarchic manner with assistance from their governments, usually limited to the opening of precarious roads. Exactly as in the North American Far West, this race for new lands is promoted or well received by most policy makers because this action is making the nation's economy and people greater as well as more secure in its territorial integrity. As in the Far West, this march to new agricultural land is also providing excellent opportunities for lumber companies, gold diggers, trappers, collectors of rare vegetal products, as well as to land speculators and bandits of any kind. As until a century ago in the then remaining frontiers of today's developed world, the natives are paying the whole cost with their lands, cultures and lives.

The effective occupation of the humid tropics was not possible, nor necessary, a century ago, but recent technological advances in transportation and medicine made it not only feasible but also relatively easy. Some millenia ago, on the other hand, large civilizations had developed in the humid tropics of Asia and America and, in Asia, these ancient settlements still exist in areas where the soils' natural fertility is good or better than average.

A major difference between past settlements in temperate areas and today's situation in the Amazon, Congo or Kalimantan is that a small but important part of mankind is aware of the consequences of the careless

utilization of the world's remaining virgin lands, and especially those of the humid tropics. It is known that, because of their very unique ecology, the tropical forests probably will not recover from the destruction underway, as most of the temperate forests did. Forty percent of the world's tropical forests have been already cleared. Eleven million hectares a year are presently being transformed into anthropic ecosystems, mostly where soils cannot support stable agriculture and the trends are going up fast. That is far too much.

### 3. SOME TRANSCENDING THEMES

Tropical forests are literally a kind of safety belt for the living earth. A broad array of industrial, pharmaceutical and other indispensable products, as well as many of the most important food plants for an increasingly hungry mankind have their origin there. The impact of growing deforestation on biogeochemical cycles, despite some uncertainties about how and how much, is obviously a very serious threat on a global scale. Nothing that is going to happen in this belt will be without consequences for the rest of the planet.

On the other hand, much of what is wrong and going wrong in the humid tropics is a direct or indirect consequence of decisions made in other biomes, mainly, but not only, in the temperate North. In most tropical countries, humid forest regions are still regarded as internal colonies which have to be exploited after their conquest, and not developed. The often mentioned "non-profitability" of managed natural forests is an example of the effect of such policy, non-profitability stemming from imposed low prices for timber or the lack of interest of foreign and national enterprises to invest in long-term operations. Many settlements and roads are financed through international credits without any environmental precaution. The reason given is that governments do not ask for any, but the reason is that it makes for a faster and easier recovery of loans and interest. That is also why most of the scarce good soils of the tropics are covered with export of crops and cattle.

Only a very small part of the present development in the tropics can be considered as sustainable. Most of the few true efforts to make development sustainable have failed for well known reasons rooted essentially in political and economic issues rather than in any lack of scientific background or technology. What is openly lacking is a context of international and social justice or, maybe, only common sense.

The wrong utilization of tropical forest resources leads to more and more poverty, and social unrest is growing everywhere as fast as human population. It is today accepted that the present situation in Haiti or El Salvador and its direct impact on US internal and external security could have been avoided if timely and appropriate assistance and funding had been given to ensure the sustainable development of both countries.

Moreover, the explosive link between narcotic traffic and guerilla and terrorist movements in South American tropical forests provides further proof of new risks for national and international security, as a consequence of wrong development strategies.

#### 4. A FEW POLARIZED CONCEPTS

The common but yet recently accepted view that tropical forest soils are, generally speaking, of a comparatively low fertility is being rejected by a number of soil scientists and agronomists who strongly support the idea that actually any kind of soils could be cultivated or grazed if advanced technology is applied. Since their proposals imply a relatively high consumption of fossil energy as well as an expensive technological dependency, the right question to ask is whether it is socially and economically viable to adopt such an alternative on lands which are, in any case, much less rich than average lands in the temperate zone. Day to day experience shows clearly that it is an almost impossible task.

Policy makers face a very difficult duty when they have to decide on an issue for which the scientists offer such opposite views. What is even worse is that they can justify any action in the name of science. The very different set of criteria applied by scientists defending both positions must be better known and understood by planners.

Another controversial issue is related to the magnitude of forest losses. Today there are no institutions or individuals who do not fully recognize the fast depletion of the tropical rain forests of the world. Existing figures, more or less backed by available information, are far from being homogenous. At first glance, in fact, some show a very desperate situation while others are much less dramatic. Looking closely, the differences become more apparent than real, but many important decisions are made on the basis of a first impression.

Are existing settlements a success or a failure? The general point of view of ecologists that settlements in humid tropics are not successful can usually be well

demonstrated if discussing long-term sustainability, but it is not necessarily true from other angles. A strong effort must be made to have a better set of criteria to evaluate a settlement after an appropriate time of establishment and the criteria should not only be acceptable to ecologists. That will mean a compromise which may facilitate future planning exercises.

Is it possible to manage natural tropical forests? The management of the natural forests could be the less damaging way or form of utilizing them. There are no violent changes in the ecosystem, nor great losses of genetic diversity. Even more, there are management alternatives which offer security against such risks. It is also clear from any soil study that a major part of the biome could be devoted to this economic activity.

However, this opportunity is being severely hampered by a strong current of opinion among several influential foresters who consider such an alternative as being unrealistic. Primarily they argue that it is not economically viable and some also claim that technically it is too difficult a task. Others, even more pessimistic, maintain that the tropical rain forests will have the same fate as the Western European forests which were reduced to minimal importance and were rebuilt when their economic impact became more obvious.

And finally, what indeed does all that which is being said and written about biological diversity and genetic resources mean for mankind? Not too long ago, the public was completely unaware of biological diversity, genetic diversity or genetic resources. An abrupt change, highlighting tropical rain forests, came about only during recent years. This strong current is, naturally, causing a reaction facilitated by several misunderstandings. The most dangerous misunderstanding concerns the not so obvious difference between genetic diversity and genetic resources. It is not evident at all, in fact, that the several millions of species which humid tropics may contain are equally useful, or even useful at all, today or in the future.

##### 5. A DESIRABLE SCENARIO

To bring together different opinions, to unify and coordinate programmes and actions, it is imperative to reach an agreement or a compromise on what is the purpose of the whole effort. In other words, it is necessary to design a desirable, yet possible, scenario for a predictable future. What could such a scenario be?

Some may consider, openly or in private, that ideally one should not to have any kind of development in the remaining tropical forests. Whatever the justifications for such a point of view, it is not a realistic approach. The other extreme, changing the entire humid tropics into a cultural landscape, like that presently covering most of the temperate latitudes of the planet, is quite a common view.

The desirable scenario would be a compromise between the "freezers" and the "developers", but would probably lean on the side of the latter. Nevertheless, it must differ strongly from "traditional development" in many crucial respects:

- i) It must be self-sustaining in the longer-term, or ensure the functioning of the natural cycles and systems.
- ii) It must offer better socio-economic opportunities leading to an adequate quality of life.
- iii) It must ensure the maintenance of biological diversity even in its evolutionary prospective.

There is no single design for such a scenario. Each country and every region in it is a very special case, fully dependent on local ecological and social characteristics as in the national political context. But, in general terms, the design must ideally consist of:

- i) A portion of the land, probably not too large in view of the usual scarcity of high quality soils, devoted to clean tilled or annual crops. Agriculture could be as intensive here as in any good soil in the temperate regions.
- ii) A much larger portion of the land under permanent crops, including industrial crops.
- iii) A portion of the land under intensive management, with cultivated grasses for livestock, mainly cattle. The livestock must also be fed on agriculture and forestry processed residues, among other alternatives.
- iv) A portion of the land, especially where soils are of a lower quality, could be managed for agriculture or livestock in a spatial or sequential arrangement with forestry.
- v) Most of the land must be under forest management aiming at goods (of any kind) and/or at services (water quality and regularity, prevention of soil losses and violent erosion, quality of the air, maintenance of wildlife, maintenance of genetic resources, recreation, etc.).

- vi) Land under forest management must also be under wildlife management.
- vii) Most water surfaces must be managed for fisheries and available wildlife.
- viii) A large percentage of the land, independent of its soil quality and of the water surface, must be incorporated into a regional or national system of protected areas, including national parks and other required categories.
- ix) Where necessary and compatible, mining and oil exploitation have to exist, as well as energy infrastructures. Obviously, the environmental requisites for such activities must be even more intensive than in less fragile temperate ecosystems.

In other words, the land must be utilized to its full natural capacity and for the long-term needs of the local population and, as a second priority, for other populations through the export of goods and services, but in such a way that the long-term sustainability of the development is not threatened. Nevertheless, the major portion of the land is to be kept as natural forests, managed for the production of goods or services or both. The management could be intensive or could be as conservative as in parks and other protected areas. The developed landscape in the humid tropics could be very similar to that existing in several parts of Europe which is a gentle combination of agricultural fields, grasslands and forests with the former being predominant in the valleys and the latter on hillsides, mountain slopes or away from rivers.

6. ELEMENTS OF A PROGRAMME TO REALIZE THE DESIRABLE SCENARIO

This section elaborates on the necessary tasks of development to achieve the desirable scenario briefly described in the previous section. Most tasks are the shared responsibilities of: i) governments and people of the tropical countries ii) governments and people of the developed countries, iii) international funding agencies, and v) non-governmental organizations of tropical and developed countries.

## 6.1 National agrarian policies to reduce unjustifiable or unnecessary pressure on virgin tropical rain forest lands

It is simply not true that in every case the reason for conversion of virgin lands into agriculture and animal husbandry is a shortage of land. There are, in fact, many other causes for it and even if this were not the case, there are several more economical ways to solve the shortage of land. The causes for the conversion problem can be found much more in imposed social structures and political constraints than in a true national scarcity of natural resources for food production.

### 6.1.1 Reforms in the land ownership

There is no doubt that many tropical countries could greatly reduce the pressure on their virgin lands (mostly tropical rain forests) if there were a better distribution of their agricultural land. Classical latifundia are still common in most tropical countries, both in humid and dry and well as in mountainous regions. Large estates are often scarcely utilized or are under very extensive pastoral use, regardless of the potential of the land. It is important to remember that very often colonization projects are only a way to avoid agrarian reforms which, in any event, would be a much more fruitful first step for the country.

### 6.1.2 Intensification of use of agricultural land.

There are two different situations under this heading: i) each hectare under production on the already improved agricultural land in the tropical forests or in any other region of the country produces far less than could be reasonably expected in both crops and livestock because of lack of appropriate technologies, and ii) a varying but high percentage of the already improved agricultural land of each tropical country is not even cultivated every year.

Both situations may occur in humid tropics or in other biomes present in the country. In the first situation, the problem is much more acute; the productivity is even lower than in other regions and, in general, only 20 to 30 percent of the agricultural land is worked every year, even when the soils are obviously fertile. Nevertheless, governments continue to promote new and onerous settlements in virgin jungles.

It is of the greatest importance to reverse the current policy of absolute preference for the expansion of agricultural boundaries as a solution for higher production, instead of intensifying productivity. Of course, more kilograms of crops per hectare and more crops per year on hectares already accessible is less attractive to many politicians than new roads and bridges, new towns and newly cleared forests. It must also be stressed that higher productivity will mean, in several cases, more fertilizers and pesticides, more mechanization and energy consumption and also more genetic improvement. Some environmentalists will have to choose that or accept more forest destruction.

### 6.1.3 Regional development outside the humid tropics

The destruction of tropical rain forests in many countries is essentially a direct consequence of human migration from deprived regions of the same country. Those regions are mainly rural. In the case of Amazonia, most of the migrants proceed from the Andes or from the dry Brazilian north-east. Both regions are traditionally considered "sans espoir", that is that they do not have the capacity to sustain the population even if land tenure reforms were made.

But the reality is far from supporting this point of view. The Andes are under-used and misused. They have tremendous possibilities to offer an excellent quality of life for even larger populations. It is only a matter of developing this potential: intensive agriculture under irrigation on already existing but abandoned terraces and in the valleys, native and exotic livestock on improved and managed pastures; afforestation for industrial, social and ecological purposes on the hillsides; wildlife management (vicuna, guanaco and others) on very high natural grasslands, are among the many alternatives. Even annual agriculture under irrigation is possible on the high plateau. But almost the entire investment budget for the agricultural sector in Peru, as one example, is allocated to irrigate the coastal desert or to build roads in the eastern jungle. The Peruvian Andes do not even receive 5 percent of the agricultural investment budget despite the fact that it

supports more than 40 percent of the poorest rural population of the country. As a result, there is an exodus to Lima and to other coastal cities or to the jungle in search of a better life.

It is evident that the rural development of areas with dense and very poor populations is another key issue to lessen the pressure on the tropical rain forest lands which, very often, are comparatively much less suitable for development.

#### 6.1.4 Colonization and national defence

Very often the settlement policy, especially in the proximity of international limits, is essentially a response to geopolitical criteria of effective occupation of the national territory. The objective is not necessarily to avoid any military threat but both to control peaceful invasion of foreign, poor landless peasants and to have a stronger economic influence in the region. Usually, those colonizations, to achieve the desired objective, need to be fully subsidized by the state.

If effective, but less expensive, alternatives (in both economic and also ecological terms) can be offered to decision makers, such as development for tourism or some categories of protected areas, such policies may be changed. International agreements may also serve this end if both sides recognize the adverse and costly consequences of what they otherwise feel obliged to do, as in the arms race.

#### 6.1.5 Industrial crops with special reference to alcohol production

When industry oriented agriculture covers too high a percentage of the best available land of a country, the pressure of the hungry poor on the tropical forests grow in direct proportion. In several countries cotton, cocoa, sugar cane, tea, rubber, oil palm, among other crops, often slated for export, compete severely against food crops.

The problem becomes even more serious when the objective of such plantations is to provide alcohol as a replacement for petroleum because the market is almost unlimited. It is urgent to study the long-term consequences of this energy policy alternative. Obviously, it will be necessary to weigh the nuclear energy option versus the alcohol programme. As far as it is already possible to compare both issues, the alcohol programme is considerably more dangerous in the long-run, even if dealing only with contamination problems.

#### 6.1.6 Consolidation of existing settlements

Governments too often, disregard the need for consolidation of existing settlements in the humid tropics in favour of new ones. Several examples exist which demonstrate that relatively cheap and easy improvements are possible in areas apparently saturated in terms of population and production, allow both to grow considerably.

Moreover, some World Bank and USAID projects of this nature have included not only the agricultural areas and their urban aspects but also the entire watershed servicing them, with excellent results both in economic and in environmental terms.

### 6.2 Appropriate planning for development in humid tropics

When the decision is made to enter and develop a tropical rain forest area, there are key options which must be considered. Some of the most important ones are mentioned in the following paragraphs:

#### 6.2.1 Integral and integrated rural development

The development style usually chosen for the humid tropics is simply an extrapolation of what is good in the temperate regions. There is no concern for the very unique characteristics of the environment, its fragility and its diversified potentialities for development. As a consequence, the proposals for utilization are not properly completed or adapted. They are commonly limited to a few agriculture items, cattle raising and, only recently, some forestry components. They usually give no

consideration to local industries, marketing or transport, which are considered an urban task and not a rural one, establishing unfavourable conditions for the peasants.

An integral and integrated rural development in the humid tropics must take fully into consideration all the potentialities of the natural resources as mentioned before and should also offer the opportunity to local communities of handling at least their own primary industry.

#### 6.2.2 Respect for the land or soil potentialities

Many colonization planners enjoy making geometrical designs. Their plans show straight roads, square plots, equidistant service centres, etc. In general, the results of detailed soil studies, drainage, topography or other fundamental criteria at the level of each parcel of ground are not taken into consideration. It is then of great importance that colonization planning be made with agronomic criteria instead of architectural ones.

#### 6.2.3 Better use of the aquatic transport potential

There is a strong bias in favour of terrestrial instead of aquatic transportation. It is even common to build roads, under very difficult and onerous conditions, perfectly parallel to navigable rivers.

#### 6.2.4 Better road quality and maintenance instead of more roads

The bad quality and maintenance of the roads servicing colonizations is one of the main causes for the economic failure of the peasants. Notwithstanding, it is common for governments to prefer to build new roads favouring and even indirectly forcing the settlers to sell their parcels to land hoarders. This problem, as well as the former, is essentially a consequence of the influence of the road building enterprises. Much can be done to avoid pressure on virgin forests if these issues were built among decision makers and financing agencies.

#### 6.2.5 Avoiding land hoarding

There is a tendency in some countries to allow the ownership of estates in the humid tropics which are far too large, thus reducing the opportunities for those without land and pushing them on to new areas. Due to the scarcity of rural workers (everyone desires his own patch of land), those estates are transformed into extensive cattle ranches, wasting the potential of the soil. Even when the initial size of the parcels is not excessive, there is a strong tendency to amass land, either legally or unlawfully, very often only for speculative purposes. These problems must be well taken into consideration, both at the planning and execution stages.

### 6.3 Agriculture in humid tropics

Part of what must be considered under this title was already discussed. The following items are complementary.

#### 6.3.1 Priority for permanent crops

Despite the fact that most permanent crops are also industrial, it is evident that they usually are better adapted to moist tropical conditions, especially when dealing with hillside soils which are highly susceptible to erosion. This is another reason to produce food crops where advisable outside the humid tropics than within them. To stimulate peasants to cultivate what is more convenient, it is necessary to build up aggressive policies of credits at adequate interest rates, market insurance, good prices, technical assistance and other promotional devices.

#### 6.3.2 Favouring multi-cropping or policulture

Combinations of crops, including especially legumes, have proven beneficial in terms of reduction of soil fertility and erosion control.

### 6.3.3 Promoting intensive small-scale cattle farming

Cattle are a good alternative for the humid tropics. These animals, in fact, are like giant termites feeding on products people cannot use directly. Cattle are competitors only if grazing on lands suitable for crops or forest, but are complementary if profiting from agriculture and forestry residues through well-known technologies which, however, are rarely applied in the tropics.

As this form of management of cattle and other ruminants is more work intensive, it is advisable to apply it at the level of each parcel of ground or in very specialized ranches if processed forestry residues are used as an important part of the diet.

### 6.3.4 Conserving soils

Instead of dealing with watershed management - too broad a concept which interferes with land-use planning and many other concepts - it is necessary to emphasize strongly all aspects of soil conservation. It is absolutely essential to use appropriate techniques for land clearing, such as wise use of bulldozers, avoidance of burning and too much soil removal. Equally important are aspects such as terracing and other techniques to avoid soil erosion; the use of green manures and an adequate application of synthetic fertilizers; improved nitrogen fixation through nodular roots and several other alternatives which may avoid soil losses, both in quantity and quality.

## 6.4 Agriculture and forestry associations

### 6.4.1 Agro-forestry

The set of technologies known as agro-forestry is not especially new and in its "rediscovery" there was probably far too much enthusiasm for its possibilities. Nevertheless, agro-forestry is unquestionably very well suited for lands with severe restrictions for clean tilled agriculture and must be strongly promoted, especially where peasants have to remain on already degraded lands.

#### 6.4.2 Management of forest fallow

As has already been stated, the land which has been cleared produces crops for a few years and after that may lie fallow for several years. The land is then covered by an often very dense forest fallow or, more properly, a second growth forest with a number of very interesting species for pulpwood, alcohol, food for cattle and other chemical forest industries; also for fuelwood and even timber for rural construction. When soils are not too degraded, these natural forests may reach a productivity which is similar to a plantation in the same condition.

Often, as in most South American humid tropics, as much as 70% of the land cleared and served by development infrastructure, is in this condition. Nevertheless, there are no provisions to manage and utilize these fallow forests, being a pure loss when cleared and burned for the next short period of agricultural use.

Millions of hectares, already ecologically disturbed, may be profitable for peasants in this way, contributing to their economic welfare and their stability, that is preventing their moving unnecessarily into untouched forests. Foresters have an important responsibility to develop management techniques for such forests and to improve the market for their products.

#### 6.4.3 Reforestation

Reforestation with native or exotic species is always a good alternative for low-grade lands which are no longer suitable for agriculture and animal husbandry or which have an excessively low carrying capacity. In this context some environmentalists must recognize that it is far better to have eucalyptus, melina or tropical pine plantations rather than nothing at all on erodible slopes. They must also remember that the timber these forests produce reduces proportionally the pressure on natural forests. A very different and unjustifiable circumstance is clearing and burning natural forests to plant other trees. Moreover, planters must be aware that a great number of native species are much better suited for reforestation than exotic ones.

#### 6.4.4 Full use of the wood in forest areas to be cleared

This is an obviously important way to provide material to the lumber industry, avoiding waste, air contamination (through wood burning) and lowering the pressure (for logging) on natural forests. However, it is not an easy task. Up to now, problems such as marketing unknown hardwood species, coordinating planning of clearing and logging operations, participation and collaboration of the peasants, among others, were not solved. But none of these difficulties are without solution. Part of the solution would be the use of steam devices to generate energy for settlements. This could be an excellent market for wood not valuable in other forms. The relation of the peasant to his forest resources will be better if, from the beginning, he makes some profit.

### 6.5 Forestry

#### 6.5.1 Forest management

The management of the natural forests for the production of goods and generation of services is a key issue in the desirable scenario because most of the land is suitable for this kind of use. Although it is true that very little has been done in this field in the tropics, there is no evidence that the goal is not realistic. In fact, some Asian countries like Peninsular Malaysia have demonstrated the technical, social and economic viability of tropical rain forest management.

The range of possibilities varies from almost purely natural regeneration to reforestation and from producing only wood up to a thousand different natural products. It is recognized that tropical rain forest management is especially difficult due to its diversity (thousands of species of trees without known market possibilities) and the high percentage of very dense timber, but the industry needs more raw material and the technologies of using mixtures of wood are also advancing, especially through chemical alternatives. This new way of utilizing wood in the form of "biomass raw material" is an answer to a more intensive use of the tropical rain forests, but also is a potential risk. As a matter of

fact, the market for alcohol or for plastics, among others, is almost unlimited and if not controlled, the "mining" of the forests could be incomparably worse than the present "creaming".

There is a very delicate equilibrium to be established in the utilization of tropical rain forests. On one hand, the natural forests must produce enough to justify their existence and not be transformed into agriculture and, on the hand, the more intensive the use, the larger the possibilities for genetic losses and, as in the former case, even the extinction of entire biocenosis is possible.

#### 6.5.2 Improving the efficiency of logging and forest industries

Many studies have shown that most of the timber (over 70%) which arrives at the sawmills in the form of logs is wasted. Adding the losses during logging operations, the result is that only a very small percentage of the wood in the forest is indeed transformed into lumber. Another problem is the lack of wood preservation which shortens the life of the timber. Much can be done in both fields to reduce the needs for exploiting new forests.

#### 6.6 Wildlife management

The management for economic purposes of the most valuable species of the tropical rain forest fauna is a necessity as part of the rural development. It is also the best form to obtain the required funds for the protection of other species without direct economic value and to offer additional justification for the conservation of the forest habitat.

Management could be achieved through very extensive methods or very intensive ones, depending on the expected rentability of the operation. Many of the most interesting species occupy aquatic environments (crocodile, tortoises, otters), but several others must be managed in areas under forestry management, as is done in temperate countries.

### 6.7 Endangered species - plants and animals

It is logical to focus more attention on the species which are more endangered, but in the tropical rain forests, it is not easy to define the target species due to the narrow and intricate species interdependency. Nevertheless, two cases could be differentiated, i) species of high economic value which are being selectively and intensively exploited and ii) species of any kind occurring in ecosystems or in large portions of land which are being transformed to agriculture through clear cutting. In the first case, it is important to give much more attention to the plants. As a matter of fact, the selective logging of mahogany may provoke a number of unexpected extinctions in the invertebrate fauna or in the microflora depending on its canopy. Nothing as violent and hecatombic could happen when dealing with spectacular mammals or birds, as in the case of species usually hunted in the humid tropics.

In the case of species of well-known economic value, the best alternative to conserve the species is through management for the economic purpose for which they are exploited today. Of course, several protective measures may also be adopted, but protectionism must be a step and not a goal. Protection is a tool for conservation, but it is not conservation. In the case of other species (the majority), the only alternative is to establish protected areas of the appropriate categories or, even better, to be able to maintain them as a result of the management of the forest for goods provided by other species.

### 6.8 Fishery

Fishery is as important as wildlife for the social and economic welfare of the local populations in tropical rain forests. Its management could be more or less extensive when dealing with river systems, but could be very intensive in natural ponds or lagoons. Another open possibility is the pisciculture, preferably with native species, instead of giving full preference to the "tilapiaculture" which is not always the best choice.

## 6.9 Network of national parks and other protected areas

It must be stressed that national parks as well as other protected areas are the only way to avoid the worst. If the desirable scenario is not attained, the unique sites which can maintain at least part of the biological diversity and may insure to a higher degree the function of the natural cycles, will be the regional, national and continental network of areas previously set aside. This is a major argument for the immediate establishment while it is still possible, of the largest and most comprehensive system of parks and protected areas.

In most tropical countries there is a need for more, larger and also better linked protected areas in order to ensure the long-term survival, the natural fluxes and the evolution of the genetic diversity. To fulfill the existing gaps, there is an evident need for local scientific research with planning criteria. It is simply not acceptable to establish a reserve for each single bird or butterfly, as has so often been proposed.

A very serious effort must be made to offer a more economical perspective for the parks and equivalent reserves. This is the only possible answer to the growing resistance of the decision makers to establish new areas of this kind. It must be demonstrated that, although not being the main purpose, these areas may consistently contribute to the local development through tourism and recreation. It is also important to demonstrate, in concrete economic terms, the benefits of the services provided to the surrounding communities.

A very fruitful tactic is to convince decision makers that new settlement projects in the humid tropics will deal with entire regions or watersheds, instead of focusing only on the agricultural lands in the bottom of the valleys. Several recent projects of the World Bank have been established through this approach, thus offering funding for the establishment and management of protected areas in the required categories.

When protected areas are established the next crucial step is to effectively manage and develop them. Priority should be given to threatened areas of any category and among categories to national parks.

#### 6.10 Tourism

Tourism in the tropical rain forests, as in other biomes of the developing countries, is handled by urban enterprises, many of them not being national. That is logical and not necessarily to blame, but it must be considered that tourism in nature, inside or outside protected areas, is an excellent opportunity for rural development. There is, indeed, an important task ahead linking the tourism business with local populations. Obviously, such a venture must be started through the national parks and other protected area systems.

#### 6.11 Mining, oil exploitation and energy infrastructure

Mining, oil exploitation or energy infrastructure in the tropical rain forests are, as in any part, a "necessary evil". The problem today is that, in general, the enterprises in charge of such ventures do not even apply the same precautions which are required in temperate countries, despite the fact that the ecosystem is more fragile and requires more care. There is much to do to correct the behaviour of the enterprises and especially to obtain a better application of national legislations, which is well written but rarely enforced.

A special problem is the tendency of some tropical governments to be megalomaniacal when facing energy infrastructures and other public work. The best example is the over-sized dimension of some hydro-electric installations in South America, or on the same continent, the proposed fluvial interconnection among the Plata, Amazon and Orinoque basins and also the proposal to form gigantic lakes in the amazon basin.

#### 6.12 Industry

Industry in the tropical rain forest must be viewed by the environmentalists as a development issue and not only as a source of contamination. A reasonable industrial network, as near as possible to the rural milieu, will contribute to the creation of employment and better salaries, avoiding poverty which is, in any event, the main cause of forest destruction.

## 6.13 Other necessary elements

### 6.13.1 About Regional priorities

A very common question concerns regional priority. There is no answer to this dilemma. What could be said is only that, in general terms, the situation is worse in Asia and Africa than in Latin America. Meanwhile, there are urgencies in some regions of Latin America as serious as on other continents. The projects in the field also depend very much on opportunity (local interest and receptivity and ear-marked funds); therefore, it is usually not possible to follow a priority role. Nevertheless, it is necessary to avoid such simple approaches as the one giving top priority to Amazonia as a whole. The part of Amazonia which is under very serious pressure is not its core but its area of contact with other biogeographical provinces, especially the Yungas between 3.900 meters and 600 meters above sea level, in the Andean eastern slopes. Such errors detract from the seriousness of the problem.

### 6.13.2 Appropriate legislation

Legislation on tropical rain forests is abundant with plenty of good wishes, but is also frequently contradictory. An example of that is the very common recognition that forest clearing and burning is an amelioration per se, even when the land is not cultivated and gives to those responsible a guarantee for further claims of legal ownership. Another usual mistake in the existing legislation is the desire to be perfect, overlooking practical application problems. As an example, the almost impossible enforcement of the rule which compels landlords to keep untouched forest vegetation as a high percentage of their estates, could be mentioned.

In general, it could be said that the legislation of the tropical countries needs to be reshaped from a more national (even regional) perspective, that is with more originality and less northern influence.

### 6.13.3 Improvement of administration

The careful study of the enforcement of any law directly and exclusively dealing with tropical rain forests will probably show that only a minimal part of it is applied. The reasons for such situations are not easily explained, but are surely rooted in the enormous lack of public awareness. This is responsible for the small budgets and, in part, for the low salaries of the administration and, as a consequence, for the lack of civil servants' commitment to their duties and is an obvious cause for corruption. Also, there is an equally important element of civic lack of discipline due to the low education level and the ready opportunity to avoid rules without any risk.

### 6.13.4 Public awareness, education and training

These are key subjects to solve the problem raised in the preceding paragraph. The first to be focused on is public awareness because it is the easiest and fastest to realize and because, through it, it is possible to have enough funding for education in natural resources (at any level), which is more fundamental, although expensive, and requires long-term action. Training is also important but its lack, in general, is not the cause of administrative weakness.

### 6.13.5 A policy for native populations

There is no doubt that the rights, even human rights of native populations of tropical forests are being trampled despite so much talk about it. No imaginative solutions have been applied by governments and traditional alternatives, like too small or too large reservations, proved to be unsuccessful to preserve native cultures and to make them available for the benefit of the whole of mankind. Therefore, it is of the greatest importance that new policies be designed on a pluridisciplinary basis and in closer relation with ecosystems conservation network.

#### 6.13.6 Long-term planning

Planning in tropical countries is usually a short-term exercise. What is worse, it is not even applied. It is very important to find ways to make long-term planning possible, if the aim is the conservation of tropical forests. Regional and national conservation strategies are a tool of unquestionable value for this purpose and must be strongly promoted and supported.

#### 6.13.7 Research

Research is an indispensable element of the programme in order to realize a desirable scenario. Most of what is needed is linked to agriculture, forestry and related soil management, but there are questions to be solved in almost every possible activity. In any case, it is essential to better connect research with the day-to-day problems of the development and to carefully choose the research projects to which to allocate the restricted funds available.

From a different point of view, it could be said that the knowledge available today on the tropical rain forest ecosystems is enough to conduct development wisely. In any case, people entering the humid tropics have no time to wait for more accurate scientific results. A great effort must be made to translate academic results into practical answers for the peasants.