

No.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEVELOPMENT OF HUMAN RESOURCES  
FOR  
THE TROPICAL FOREST MANAGEMENT  
(STRATEGY FOR THE BRAZIL)

MARCH 1993

JAPAN OVERSEAS FORESTRY CONSULTANTS ASSOCIATION  
(JOFCA)

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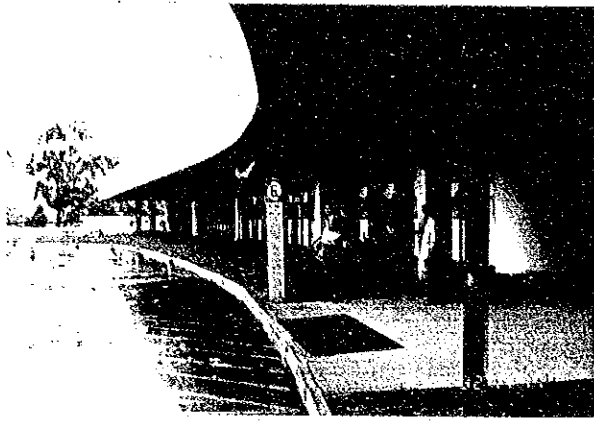
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**MARCH 1993**

**JAPAN OVERSEAS FORESTRY CONSULTANTS ASSOCIATION  
(JOFCA)**

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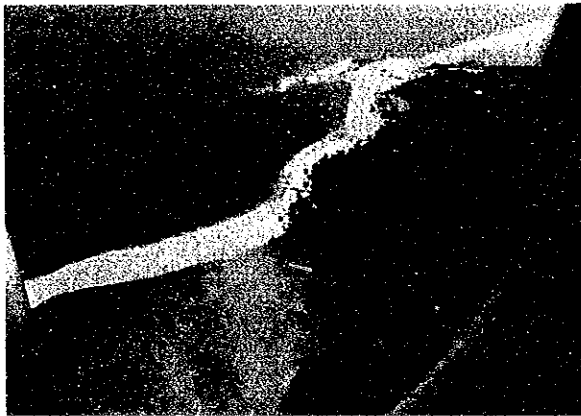
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The IBAMA Headquarters in charge of forest management in Brasilia.



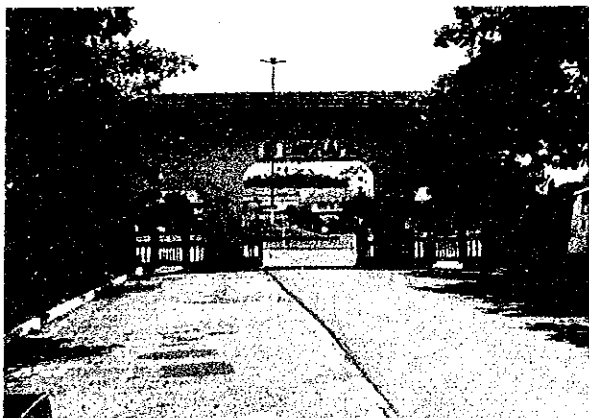
INPA in Manaus; every building is surrounded by forests.



The Amazon's varzea (2 % of the total) exposed in dry season; busy with cultivation and harvest before flooding.



A training room in the SUDAM's Lumber Technical Center in Santarem.



EMBRAPA (CPATU) in Belém.



IBAMA's branch in Belém.



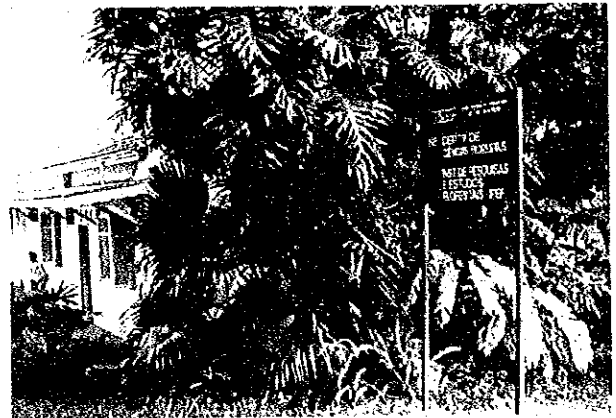
Faculty of Agricultural Science of Pará; the Forestry Department and was set up later.



The Amazonian area is difficult of forest plantation. Good soil and correct selection of species will enable forests to be created. An experimental forest of Heavea Brasiliensis (Faculty of Agricultural Science of Pará)



Meeting with Professor Pellico (left), Director of the Forestry Department, Federal University of Paraná.



The Forestry Department of São Paulo University.



NMA (the EMBRAPA's Environmental Monitoring Center) in Campinas.



INPE (National Space Research Institute) in São Paulo.

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## 1. Introduction

The current rapid decrease and deterioration of tropical forests are posing a grave threat to human beings, and the settlement of this problem has drawn world-wide attention.

Such a decrease in tropical forests has exerted a serious influence on the social economy of developing nations that depend on agriculture, livestock farming and forestry. In addition, the decrease has also become the subject of discussion relating to the whole world, and allows no time for delay in settlement to protect the global environment from the extinction of living species in tropical forests, global warming, and other difficulties.

In order to resolve the problem, diversified measures are required, and steps for the protection of forests and afforestation in developing nations are fundamental. However, it is an undeniable fact that in taking such steps, developing nations are short of local forestry officials, qualitatively and quantitatively, for forest management and afforestation.

Based on the recognition of problems mentioned above, this study aims at preparing and proposing, by nation, guidelines and methods for training tropical-forest management officials.

The study was conducted in Brazil in November, 1992.

## 2. Current Situation of Forests

### (1) Current Situation of Forests

The nationwide survey of forest resources in Brazil was carried out by IBDF jointly with the Commission on Science and Technology, SUDAM and universities. The area of forests in 1985 is about 5.5 million km<sup>2</sup> as shown in Table 1, accounting for 65 % of the national land about 23 times larger than Japan. Most of hardwood closed forests covering an overwhelming area are concentrated in the Amazonian region. Some are national and public forests, while the remaining majority are privately owned.

Table 1 Forest Areas

in thousand ha & percentage

Softwood Forests			Hardwood Forests			Grand
Closed	Thin	Total	Closed	Thin	Total	Total
13,520	0	13,520	382,510	157,000	539,510	553,030
						Territory Forests 851,197 65.0%

Source: FAO

Most of closed forests in the Amazonian region are tropical evergreen wet forests, and classified into terra-firme forests and varzea forests. Infrastructure is generally undeveloped, especially in terra-firme forest areas. Besides them, there are low forests of Caatinga, and dry half deciduous forests in the middle reaches of the Amazon, though small. Woodland occupies an extensive area mainly in the inland zone. "Cerrado" is distributed over 170 million ha on the immense highland covering Rondonia State in the southwestern part of the Amazon, Piauí State in the northeastern part of Brazil, and the northern part of São Paulo and Minas Gerais States. It covers just the central part of Brazil. Chaco stands distributed near the border with Paraguay occupy an area of 1.5 million ha, while Pantanal complex distributed in Mato Grosso State occupies an area of 12 million ha. Cerrado has different types of forests ranging from relatively closed Cerradao whose dominant trees reach nearly 20 m high to Campo Cerrado where trees and shrubs sporadically exist. In recent years, however, it

is apprehended that the area of Cerrado is rapidly decreasing throughout the country owing to the aggressive felling of Cerrado to produce charcoal for iron manufacture in São Paulo and Minas Gerais States as well as forest fires, diversion to agriculture, and pasturing. Therefore, it is needed to expand man-made forests of Eucalyptus and others.

Natural forests initially decreased dramatically along the South Atlantic coast actively developed from early days. After 1960, however, the decrease is remarkable in Cerrado in the midwestern part, Caatinga in the northeastern part, and tropical forests on the Amazon.

According to the FAO's project for assessing tropical forest resources, it is estimated that annual decreases in the area of natural forests on the national average are 1,360,000 ha of hardwood closed forests, 120,000 ha of softwood closed forests, and 1,050,000 ha of thin stands, totalling 2,530,000 ha. However, the decrease in the area of forests owing to settlement and agropastoral development has tended to be decelerated since 1980. This is because the government withdrew its assistance from the development of pastures in forest areas, and the working group coordinating ministries for Amazonian development considered a reduction in the area of farmland to less than 4 %.

Amazonian development is promoted mainly by SUDAM, the Ministry of Home Affairs under the general project for Amazonian development in cooperation with the Ministry of Agriculture (INCRA, formerly IBDF and presently IBAMA), the Ministry of Construction, and the Ministry of Mines and Power. The project divides the region from ecological and economic points of view into the agricultural and forestry development zone, the forest conservation and protection zone, and the wildlife sanctuary. It aims at rational development through the designation of these zones, improvement of wasteland, and manpower training. Forest management in the region is based on the sustainable production of the present resources mainly through natural regeneration and enrichment planting of useful species.

According to the FAO's project for assessing tropical forest resources, it is estimated that the total stock of natural resources is composed of 51.7 billion m<sup>3</sup> of closed forests and 5.8 billion m<sup>3</sup> of productive thin forests. The stock of productive closed forests is 47 billion m<sup>3</sup>, 94 % of which exists in the northern part of the Amazon, and yet largely remains undeveloped. It is also estimated that the economically usable stock of productive closed and thin forests is now composed of 1.5 billion m<sup>3</sup> of closed forests (14 million m<sup>3</sup> of softwood) and about 600 million m<sup>3</sup> of Cerrado thin forests.

## (2) Man-made Forests

According to the FAO's estimation of man-made forest areas by species and planting year, the total area of such forests is 3,046,000 ha (1985); it began to rapidly increase in the second half of the 1960s, especially after 1976 on an annual basis. In terms of species, introduced Eucalyptus and Gmelina arborea as well as exotic Pinus spp. account for 80% or more of the total (Table 2). Local species represent no more than about 543,000 ha, including fruit and palm trees.

Table 2 Planted Areas

Category	in thousand ha				Cumulative Total
	Until 1955	1956-65	1966-75	1976-85	
All Softwood	11	59	666	1,109	1,845
Pinus spp.	1	24	620	1,080	1,725
All Hardwood	10	101	337	753	1,201
Eucalyptus spp.	10	80	270	640	1,000
Total	21	160	1,003	1,862	3,046

Source: FAO

Planted species under Eucalyptus representing the majority include mainly Eucalyptus saligna, E. grandis, E. alba, E. urophylla, E. citriodora, E. tereticornis, E. paniculata, together with E. camaldulensis, E. cloeziana, E. dunni, E. globulus, E. maidenii, E. pilularis, E. viminalis, E. pellita, and E. torelliana.

Planted species under Pinus as softwood mainly include Pinus taeda, P. elliottii (var. elliottii, densa) and P. patula as exotic species adaptable to the subtropical zone, and P. caribaea (var. hondurensis caribaea, bahamensis), P. oocarpa and P. khesya adaptable to the tropical zone. Other softwood species include indigenous Araucaria angustifolia and exotic Cunninghamia lanceolata, Cupressus lusitanica, etc. Among softwood species, Pinus occupies an overwhelmingly large area of plantation.

Among local hardwood species we can find such local popular species as Nectandra mollis (black cinnamon), Ocotea prattosa, Copaifera langsdorffii, Balfourodendron ridelianum, and Phoebe prosa. and such fruit bearing popular species as Psidium guayana (goiaba), Paullinia cupena (gurana), Bertholletia excelsa (Brazil nut), Citrus spp. They occupy only small areas.

Brazil has recently succeeded in developing man-made forest resources of Pinus and Eucalyptus, and developed lumber industries based on these resources. Lumber products are becoming key commodities exported from this country.

The following factors are considered to have contributed to the development of the forestry sector in Brazil.

- 1) The territory is immense enough to provide low cost sites suitable for forestry.
- 2) The land is flat, and there are certain sites suitable for forestry accessible to markets, where intensive afforestation is possible on a large scale.
- 3) Wages and planting costs are very low.
- 4) Pinus and Eucalyptus species grow well, and secure a short period of capital recovery.
- 5) Infrastructure is well developed.
- 6) Forest industries, including saw-mills and pulp plants are intensively and reasonably located near plantations, and moreover, logs are rationally used. These conditions enable

product cost to be reduced.

- 7) The long tradition and experience of agricultural plantations have led to the good management of business and labor for large-scale and intensive afforestation projects.

In addition, more harvests, quality log production, and cost reduction are pursued through technological development including tree breeding, silvicultural site classification (the survey of the right species on the right site), improvement in the silvicultural manual, forest fertilization, and mechanized afforestation.

### **3. National Forestry Policies**

To cope with expanded timber demand and a rapid decrease in natural forests, the government set up the IBDF and developed various forestry measures in the second half of the 1960s. The progress of its efforts will be outlined in the following.

**(1) Enacting the New Forest Law (Law No. 4771 in 1965)**

This law, as incentive to re-/af-forestation, provides reductions in or exemptions from real estate and assignment taxes on woodland and exemptions from income taxes on forestry. Companies which use timber as raw material are obliged to supply 50 % of required timber from their own plantations. In the case of re-/af-forestation, natural forests must be conserved at least 20 % of the project area.

**(2) Taking Income Tax Reduction and Exemption Measures (Law No. 5106 in 1966)**

When corporations and private citizens have undertaken afforestation, expenses incurred by them may be deduced from assessed corporate income taxes or from personal incomes as a basis for income tax assessment within a range of 50 %. Since the enactment of this law, the area of plantations has remarkably increased.

**(3) Establishing the Fiset (sectorial investment fund) (Law No. 1376 in 1974)**

This fund is collectively invested in projects for afforestation, fisheries, and tourism in order to mainly promote regional development of the Amazon and the north eastern part in a comprehensive way. Although various funds were conventionally invested individually and separately in the forestry sector, this system has made it possible to invest them intensively and effectively in high-priority areas, such as the northeastern part and highly productive areas, and consequently afforestation in the northeastern part has dramatically been expanded.

(4) Supportive System for Small and Medium Land Owners

The government assists small and medium land owners through the REPEMIR program for afforestation. The budget covers 120,000 ha of afforestation and an output of 130 million seedlings.

(5) Forestry Seeds

The government set up a commission for forestry seed control within IBDF, and supervises the use of domestic and imported seeds by preparing their minimum quality standards. The use of seeds from the forestry seed stands designated by IBDF is assisted at a high rate. The area of the designated stands reaches 4,300 ha.

(6) Liability for Testing and Research

Projects which have received aid from the Fiset are required to spend 1 % of their respective operation costs on testing and research. The purpose of this requirement is to increase harvests from man-made forests. Testing and research, being supported by EMBRAPA established by the government, research organizations managed by state governments, and universities, have achieved lots of results, including tree breeding.

Moreover, environmental conservation has been emphasized as one of the large props of forestry policies in recent few years. It is said that reckless agropastoral development and shifting cultivation have so far destroyed several million ha of forests in the Amazonian region. Until the first half of the 1980s, the problem of natural conservation was shaded by economic development in determining the order of priority. Although this problem was often taken up from the 1960s, the government could have no allowance for approach to the problem, but just recognized the presence of the problem.

Subsequently, the people became aware of conservation, and pressure for conservation from overseas was increasingly put on the government, which has gradually come to take various measures for natural conservation. However, it is not rare that the government often faces much difficulty in exercising its authorities, when



industrial activities are closely related to local politics and economy.

As previously stated, the IBDF affiliated to the Ministry of Agriculture had jurisdiction over forestry policies of Brazil. In October, 1988, however, a natural conservation program was established by the government ordinance, and in January, 1989, to promote the program, environment-related agencies including the IBDF were integrated into a new organization called the IBAMA.

Along with the SEMAN, one of great roles of the IBAMA is to coordinate interests with other ministries and agencies which perform activities in the production sector in accordance with economic policies. The IBAMA also pays attention to education and extension in response to environmental problems. Under the new program for forest development and conservation, it developed a five-year plan for training technicians required for conservation, and extensively enlightening companies and the general public.

However, it is a question whether these efforts will be effectively completed in face of various problems, including a deficient appropriation, optimistic environmental assessment, the insufficient provision of relevant organizations and laws, and a shortage of experts in environmental problems. In the long perspective, it is a critical problem for future to maintain the consistency of this policy for conservation.

#### 4. Organization of Forest Management and Conservation

##### (1) Agencies in Charge of Forest Conservation

The IBDF (established in 1973) affiliated to the Ministry of Agriculture was conventionally responsible for forest policies of Brazil. In recent years, however, reckless development and shifting cultivation have destroyed over 2 million ha of forests every year. In response to this, a natural conservation program called "Planeta Nossa Natureza" was established by the government ordinance in October, 1988, and moreover, environment-related agencies including the IBDF were integrated into a new organization called the IBAMA in January, 1989.

In nations, like Brazil, which have an immense territory like a continent and face a financial crisis, it is a permanent problem for the federal government to take a complicated responsibility for conservating natural resources and maintaining the quality of national life.

To vitalize activities in this field, the government of Brazil determined on unifying the government structure of environmental management, and integrated the IBDF, SEMA, SUDEPE, and SUDHEVEA into a new organization called the IBAMA.

Thus, the government integrated promotive activities, research and monitoring in forest and fishery zones and national ecosystem conservation areas into one organization. Consequently, the government plan and action in the environment sector were given a comprehensive vision.

The establishment of the IBAMA became a new model for environmental management. Its fundamental features are as follows.

- 1) Integration: The protection of natural resources and the rational use of forests, water resources, and fishes were formerly under the control of different government agencies. These responsibilities are now uniformly placed on one organization. In particular, the control of environmental pollution was improved.

- 2) Organization: Environmental policies of every state were unified and concentrated in one organization. The nation takes a responsibility for environmental policies to states and counties.
- 3) Autonomy: The decisions by the CONAMA will be made to be ordinances by states or cities. Every municipalities are fundamentally responsible for the problem of pollution. If a municipality cannot afford to fulfil its responsibility, a branch of the IBAMA will support it. However, the IBAMA prefers to autonomy.

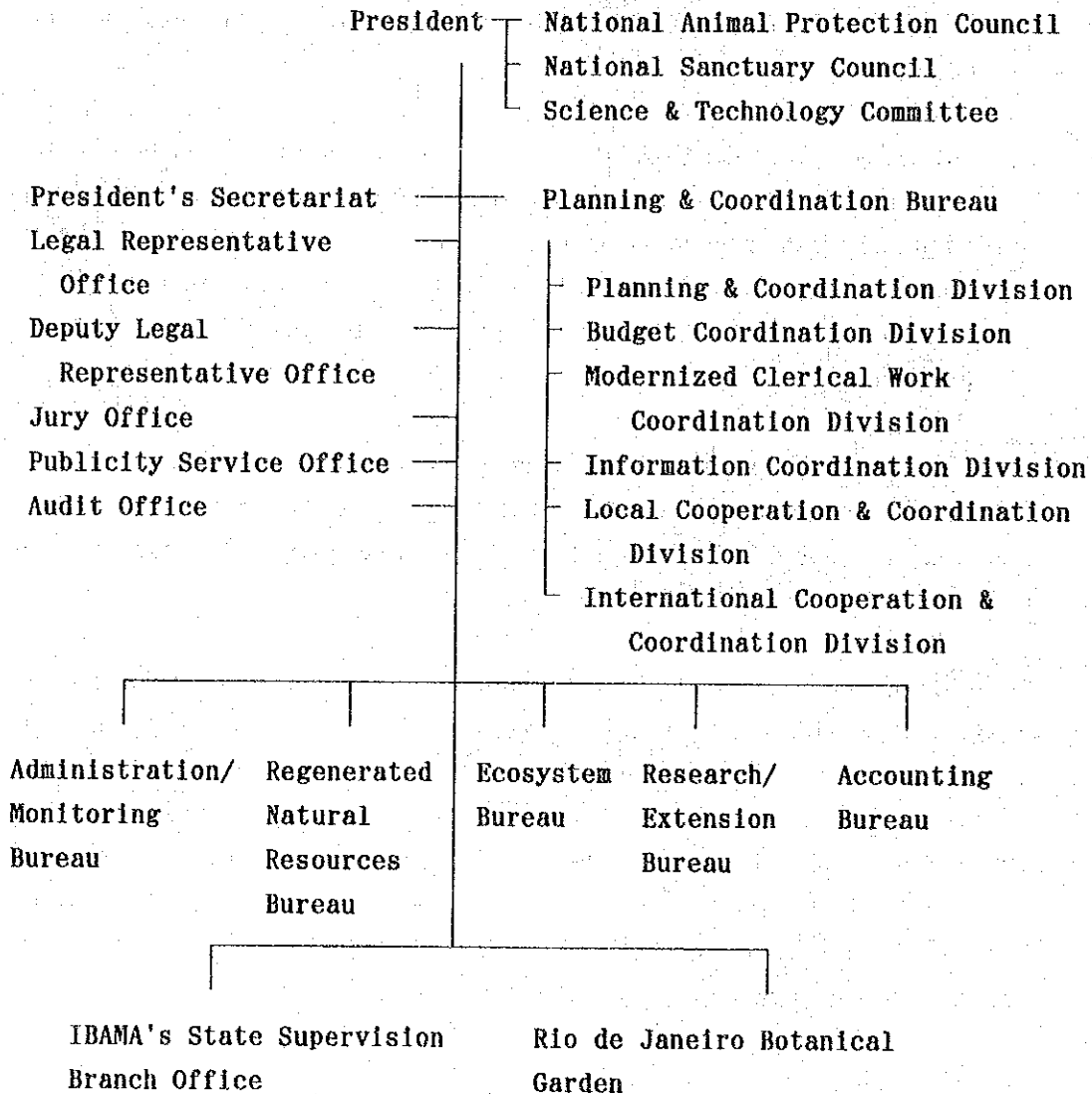
The IBAMA was established as a government agency responsible for enforcing laws concerning the environment and forestry in Brazil, and has a number of regional offices throughout the country to completely enforce a wide range of laws.

The IBAMA has a staff of 600 members at the headquarters and a staff of about 1,800 at regional offices, though it has jurisdiction over a total area of 553 million ha, larger than the Continent of Europe extending 490 million ha. The staff are too small for complete enforcement. Therefore, it is intractable unless every forest owner consciously abides by laws. (For your information, Japan intends to manage 7 million ha of national forests by the organization of 20,000 administrators.)

The area under the control of the IBAMA includes the world largest closed tropical rain forests, which are not easily accessible by normal means because roads have not usually been constructed anywhere. It is a very lucky case and quite rarely found if a waterway like a river or even a low-standard road exists. Moreover, hinterland forest exploitation is an illegal action, including secret mine development and illegal hunting, which are very difficult of regulation.

The duty of the IBAMA is entrusted to some advanced state governments, such as São Paulo, Minas Gerais, and Paraná. The organization of the IBAMA is shown as follows.

## An Organization Chart of IBAMA



The Collor Administration started in March, 1990 focuses its policies on active conservation of the natural environment, including tropical rain forests. The system of IBAMA was reinforced, and the development of environmental policies was consistently entrusted to the Environment Agency under the direct control of the President. Accordingly, forest-related policies are now focused on the environment. The Environment Agency develops a policy, which is implemented by IBAMA in view of forest protection and monitoring rather than forestry promotion.

## (2) The Forest Law and Conservation

On September 15, 1965, the new forest law was enacted, providing the designation and coverage of permanent forests, restriction on virgin forest exploitation, the use of forests, illegal and prohibited activities in forests, and preferential measures for plantations and regenerated forests.

### 1) Permanent Forests

#### (a) Forests along rivers or other streams

- Forests 5 m wide if the river is 10 m or less wide.
- Forests half the width of the river, if it is 10 - 200 m wide.
- Forests uniformly 100 m wide if the river is 200 m or more wide.

#### (b) Forests around natural and artificial lakes, ponds, and reservoirs.

#### (c) Forests on the top of hills, mountains, and ranges, and slopes of 45 degree or more.

#### (d) Others declared as permanent forests in accordance with public requirements.

### 2) Restriction on Development

#### (a) It is, as a rule, prohibited to develop the Amazonian region. If developed, certain conditions and technology must be met.

#### (b) Over 20 % of the area to be developed shall be reserved in the southeastern, southern and midwestern parts, whether it is a virgin forest or a regenerated forest.

#### (c) The exploitation of virgin forests shall be permitted up to 50 % of the owned uncultivated land to newly develop farmland.

### 3) Forest Maintenance

Companies which consume a large amount of raw material from forests are obliged to sustain forests and develop supplementary plantations for raw material.

### 4) Preferential Measures

(a) Owners of replanted areas covered by permanent forest areas and virgin forests are exempted from land ownership taxes.

(b) Forest products which planters gain from planted areas shall be exempted from taxation.

(c) Expenses on afforestation and reforestation shall be deducted from income and special taxes.

### (3) Environmental Assessment System

The year of 1981 was a milestone in environmental policies of Brazil. The emphasis on development was reviewed, and "National Environmental Policies" were announced with the intention of establishing the implementation system of policies mainly for environmental improvement and recovery. The environmental law as its basis was enacted, and the CONAMA was organized to establish a national environment system. In 1986, following the resolution by the CONAMA, the government of Brazil required projects which might affect the environment to prepare an assessment report (EIA/RIMA). Projects which must meet this requirement include "those which will develop fuelwood and lumber in an area of 100 ha or more, and even if less than 100 ha, those which will be important from an environmental point of view."

### (4) Sustaining Forests by Re-/afforestation (sustainable forestry production)

Under the plan called "Planeta Nossa Natureza", a government ordinance was enacted in 1989 to reinforce the forest law. The ordinance requires consumers (companies) which use 12,000 m<sup>3</sup> of lumber or over 4,000 m<sup>3</sup> of charcoal to possess plantations to cover

their consumption. They must submit their respective plans to the IBAMA for forest maintenance and re-/af-forestation to establish a self-supply system by 1995.

(5) Restriction on Amazon Development

The conventional development-first policy has exerted an effect on the Amazonian region, and taken preferential measures for projects approved by the SUDAM, including exemption from income taxes and low-interest loans. Many projects were carried out especially for livestock farming as the most important use of exploited forests. Although it was determined in 1979 that any new project in the Amazonian jungle would not be approved, projects already under way or implemented in intermediate forests have been approved. This consequently accelerated Amazonian forest exploitation. In 1989, in accordance with the forest law, an government ordinance was enforced to suspend the preferential measures and public loans for livestock farming in Amazonian dense, intermediate and thin forest areas (excluding low marshes, Cerrado, and natural plains). The ordinance places restriction on agricultural development including single crops in dense, intermediate and thin forest areas, excluding fertile areas.

## 5. Forestry Education

### (1) Review of Forestry Education, and the Testing, Research and Extension System

Universities in Brazil were subject to educational system reform by the decree in 1964. Currently, 20 universities and colleges have forestry courses. These universities and colleges not only educate students, but maintain cooperative relations with national and public research institutes for research and extension activities. The domestic testing and research system and collaboration are as follows:

As previously stated, in the second half of the 1960s, the government of Brazil enacted a new forest law, established the IBDF, and implemented a number of policies, including reduction in and exemption from income taxes on investment in afforestation and the creation of an afforestation fund as part of government assistance for the purpose of active expansion of man-made forests. Subsequently, the government powerfully developed policies for promoting testing, research and extension activities, including the development of the national program for forestry research, the establishment of the comprehensive research system covering the government, universities and the private sector, and the test and research requirement for government assistance.

Since 1966 when the government launched powerful assistance for afforestation by the above-mentioned measures including tax reduction, forestry tests and studies have been carried out on a full scale by private companies because they are indispensable to large-scale afforestation. In particular, re-/af-forestation species and silvicultural manuals began to be jointly studied by universities and companies. The IPEF was set up at São Paulo University in 1968, and subsequently, the FUPEF was founded at Paraná University, and the SIF was established at Visoza University. The IBDF started a program for forestry development and research with the support of FAO/UNDF in 1971, and promoted tests and researches concerning industrial afforestation in collaboration with Visoza University and private companies.



Owing to the oil shock in the second half of the 1970s, the production of wood fuel urgently needed to be increased, and simultaneously, environmental conservation was strongly requested, so that requests for tests and researches were diversified. In 1977, the IBDF entirely entrusted forestry tests and researches to EMBRAPA, and moreover, developed the PNPf to comprehensively promote tests and researches ranging from industrial afforestation to the increased production of alternative energy, and environmental conservation. This program identified objectives and key subjects of forestry research, and expected EMBRAPA to take the lead in reinforcing cooperation among state forestry research institutes, universities, their research laboratories, and private companies so that tests and researches may be effectively promoted through joint research to avoid overlapped subjects of study.

The key objectives of research covered by the PNPE are:

- a) Rational management systems of natural forests in the Amazonian region;
- b) Tree breeding for abundant harvests and quality lumber production;
- c) Wood energy production;
- d) Nutrient circulation in man-made forests and their growth;
- e) Improvement in marginal soil in colonial development areas;
- f) Management systems of agroforestry in the northern and northeastern parts; and
- g) Reduction in logging and transportation costs.

In the southern part, people have concern about damage by insects and soil degradation following the simultaneous planting management of a single species with a short cutting period. This is why efforts are made to breed varieties resistant to various damages and develop techniques how to properly maintain the plantation fertility, and moreover tests are carried out on composite forest systems for the simultaneous production of fuelwood and pulp wood (short cutting period) and construction wood (long cutting period) in order to review indigenous species and extend cutting period.

The organizations and general information of typical universities and testing and research institutes are summarized in the attached

reference.

(2) The Number and Technical Level of Technicians in Tropical Forest Management

1) Universities

As already mentioned, universities which provide forestry education amount to 20 throughout Brazil. Of them, Pará, São Paulo, Visoza, and Paraná Universities are prestigious, having a relatively long history. Many other universities were founded just several years ago in response to concern about environmental conservation and forestry, and therefore, have produced few graduates.

There were less than 170 graduates every year in the whole of Brazil (this figure was presented by some universities).

Graduates from prestigious universities will be summarized in the following.

a) Pará University

(Forestry Department in 1961)

About 40 graduates on the annual average

50% Government offices, universities, research institutes

20% Private companies

30 % Self-employed and others

b) São Paulo University

About 20 graduates on the annual average

10% Government offices, research institutes

85% Private companies

5% Self-employed and others

c) Paraná University (Forestry Department in 1961)

About 30 graduates on the annual average

(the half drop out)

10% Government offices

10% Research institutes and others

80% Private companies  
 10% of the total enter graduate schools later.

d) Visoza University (founded in 1960)

e) Mato Grosso Federal University

Brazilia University	] set up forestry courses in the 1970s
Rio de Janeiro University	
Santa Maria University	

f) Forestry courses at other universities are relatively new.

Based on the results of a survey by FAO, the staff of Brazilian forestry administration agencies are as follows:

University Graduates		Middle-class Technicians		Trained Staff		Untrained Staff	Total
Forestry	Others	Forestry	Others	Forestry	Others		
127	64	-	58	156	506	453	1,364

The mainstay of Brazilian forestry administration agencies in 1974 was the IBDF as the predecessor of the IBAMA. Although the organization of the IBDF was expanded later, some staff members who graduated from universities shifted their careers to the private sector in succession after it was replaced by the IBAMA. Nevertheless, the employment of recruits is withheld.

According to the above table, it should be noted that (1) foresters who are university graduates account for slightly less than 10 % of the total, and (2) middle-class forestry technicians are not available. In fact, there are now only very few middle-class forestry technicians anywhere in this country.

Now, it should be considered where and how many technicians who graduated universities are available in Brazil. As previously stated, about 170 foresters currently graduate from

universities every year. However, it is presumable that the number was less in the initial stage. The total of graduates in the past 30 years may be around 4,000. Of them, those who changed their courses (or left from forestry sector) are probably not a few. It can be assumed that graduates now engaged in forestry are no more than 3,000.

On the assumption that of them, slightly less than 30 % joined government offices, research institutes or universities, and slightly more than 70 % joined private companies:

- (i) Government offices, research institutes and universities  
about 700
- (ii) Private companies about 2,300

Whereas the area of forests in Brazil is 550 million ha, larger than that of the total area of Europe, the number of some 3,000 is very deficient. If participants in the sector of forest product processing are excluded from the number, a shortage of human resources is more serious.

These foresters having received higher education represent the elite, and the majority of them work in comfortable places, such as urban offices, research institutes and universities. Some act as local supervising foresters in rare cases.

## 2) Forestry High School Graduates (middle-class technicians)

According to the above-mentioned survey by FAO in 1974, there were no middle-class technicians who graduated from forestry high schools in the administrative organization.

The interview survey in this study shows that the training system of middle-class technicians for the forest management is extremely poor.

In this situation, the only recognized forestry high school exists in Irati in the state of Paraná.

Irati Forestry High School is located 200 km west of Curitiba. Junior high school graduates aged 14 are eligible for admission. Forty students enter the school every year to receive three-year forestry education. Some of graduates from the school pass the examination for government officials, while the majority of the others are employed by private companies.

When it was asked if forestry education at the level of high school was really given only in Irati, it was answered that high schools specializing in agriculture, forestry and livestock farming existed actually in many states. Graduates from these schools did not really master techniques of the required level for middle technicians. Therefore, many organizations do not employ them in the hope of good performance.

The reason why good students do not enter these schools is that agriculture and forestry do not offer rewarding jobs to graduates.

There is a kind of vicious cycle where the absence of jobs causes a shortage of workers, while the absence of good workers causes employers to be reluctant to offer jobs.

At any rate, although 15,000 companies (registered at IBAMA) manage forests, 40 graduates per year are actually recognized as forestry high school graduates. 40 is too small to recognize, but an actual situation. It should also be noted that the poor treatment of high school graduates raises a significant problem.

### (3) Problems for Forestry Education

In the 1960s, the government of Brazil took preferential taxation measures for developers of natural forests. As a result, the development of natural forests was accelerated in the Amazonian region and the southeastern part, where farms and ranches were newly developed. On the other hand, paper and plywood companies conducted the large-scale felling of natural forests. In this period, it became a significant movement to plant fast-growing

species in logged-over areas. From the 1970s through the first half of the 1980s, the study of techniques for creating forests of fast-growing species (Eucalyptus and Pinus) and the survey of their growth under various conditions of location were carried out on a nationwide scale. These fields of study were also emphasized in forestry education and training at universities and research centers. In the second half of the 1980s, however, the simultaneous large plantation of these fast-growing species provided negative factors throughout the country. For example:

- 1) In many of plantations without full analyses of their sites, the initially expected growth could not be achieved.
- 2) Introduced species were susceptible to damages by local insects and fungi. They were browsed by borers after they grew to some extent, and lost their value.
- 3) Many of fast-growing species have as a short cutting period as 8 to 10 years, and generations are alternated in a short term. This consumes soil fertility, and considerably decelerates the growth of trees after three or four generations in some cases.
- 4) Despite growing quickly, fast-growing species are qualitatively inferior to others, and their utilization is limited. Accordingly, they are cheap and investment in their plantations is less profitable.

Thus, the value of natural forests of useful indigenous species was appreciated anew in the second half of the 1980s. This promoted studies and researches concerning the regeneration and tending of natural forests. Forestry education at universities and training centers also reflected this trend.

On the other hand, as previously mentioned, forestry and forest industries have been expanded and diversified in Brazil. To cope with this, training technical officers is strongly requested mainly by the field sector. Forestry education at the level of university is relatively satisfactory and given to many students. Graduates join the management sector in many cases, and seldom go to the field sector. The education and training of technicians and

workers of middle class or lower who work in the field are undertaken by some junior colleges, the CTM of SUDAM, Irati Forestry High School and others. There are only a few facilities for training persons required, and the content of training is not satisfactory. It is strongly recommended that these educational facilities should be expanded in both quantity and quality.

Another problem is to foster experts in environmental problems which have caught attention of people in recent few years. Experts in such problems are extremely deficient because forestry education has conventionally been focused on production. People engaged in education are frustrated by the impossibility of shifting their courses even partially. On the other hand, foresters and educators challenging environmental problems are not highly appreciated in the society and therefore in the office. This situation makes it difficult to secure excellent human resources. This also raises a problem. As already mentioned, the IBMAM tackles this problem in a comprehensive way.

## 6. Proposals

### (1) Features of Forest Management in Brazil

- 1) The territory of Brazil is extensive. There are many remote areas which are not accessible to people. Whereas only a few forestry people are engaged in forestry which has no long history, extremely many people wish to earn money in a short time by developing forests and using land. The proper management of forests cannot be expected as far as they are left without control.
- 2) Most of forests are privately owned, except for national parks, and public parks and forests owned by some states. Private forest owners generally give priority to their own interests, and rarely sacrifice themselves for public interest and the world.

These owners registered at the IBAMA exceed 15,000, and employ costly foresters for good forest management only when the employment eventually accrues interest. Such cases are not so many.

- 3) The management of Amazonian forests attracting the most global attention is very difficult, and faces lots of technical problems to which solutions are urgently needed.
- 4) As everybody knows, the national finance of Brazil is in a extremely severe situation, especially with external debts.

As a result, Brazil as a nation cannot but give priority to economic development, and introduce fiscal retrenchment. In fact, the government withholds from employing recruits, and makes salaries remain at a lower level than the private sector. Many officials take other professional opportunities in succession.

- 5) More transportation costs in remote areas lead to the selection of economic development capable of bearing such costs (other than forest development and forestry).



In terms of forest management, remote areas also take more costs, and make management and supervision less efficient.

(2) Training of Forestry Technicians in Brazil

- 1) As previously stated, it is impossible to make the same cooperation for forestry in Brazil as in ASEAN members. This is because Brazil does not manage its national forests or organize forestry offices across the country.

It is not easy to institutionally train technicians from forestry companies as management organizations and forest owners.

Cooperation in training forestry technical officers should be elaborately carried out.

- 2) It is regrettable that forestry officials in IBAMA seem like to seek for other professional opportunities. The IBAMA should improve salaries and make forest supervisory duty safe and rewarding.

The IBAMA is responsible for managing national parks, and managerial cooperation with them will secure many benefits.

If equipment and facilities are replenished for the management of national parks, the staff's morale will be improved so that the parks may be managed in a better way.

If the staff learn the management of forests and parks in other countries, it will benefit the management in their own country.

It can be expected that the proper management of national parks will eventually exert a good effect on the proper management of general forests.

More important, the staff will be encouraged to continuously work for the IBAMA.

The advanced area to which the IBAMA contributes is the study of forest product processing. This area makes rapid progress, and the area needs cooperation.

### 3) Partnership with States

Brazil is too immense to carry out cooperation at once throughout the country. Its immensity overwhelms us and does not allow us to expect the immediate effectiveness of cooperation.

As demonstrated by cooperation for forestry in São Paulo, cooperation with states is more available. The selection of a promising place makes it easy to evaluate the effectiveness of cooperation. In some states other than São Paulo which own their respective forests, such as Minas Gerais and Paraná, it is possible to cooperate with them for training technicians in the management of the state forests. Beginning with such cooperation, we should pick up appropriate states for further cooperation from time to time.

Promising areas of cooperation (in training technicians) include the management of the watershed and parks, breeding, and forest product processing.

A technical requirement is post-graduate level or high school level.

- 4) In South America including Brazil, the cooperation with private forests has already achieved various results. Such cooperation is easiest and most realistic in nations whose forests are mainly private, such as Brazil. If a good plan for cooperation is found, it will necessarily involve manpower training as well as financial assistance. An area of cooperation is sustainable development through the creation of forests and the processing of forest products, which will lead to the proper management of forests and the entire watershed.

The World Bank is virtually introducing funds into forestry in the Amazonian region and Uruguay. Multi-funds introduction will enable appropriate measures to be taken for forestry and proper forest management in states which attach importance to forestry in Brazil. For this purpose, manpower training is essential.

- 5) Another option of cooperation for private forests is to collectively train middle-class personnel who graduated from high schools. For this purpose, a "forestry training institute" will be established in consultation with relevant leading companies. Trainees will be high school graduates, and intensively receive practical training for about one year. Training will be focused on practical fields of study, such as afforestation, forest product processing, and mechanized forestry. Although companies may send trainees to the institute, it should be fully considered who will bear training costs in order to put forward the plan. Trainees will be sought not only from initial participants, but also extensively as many as 15,000 forestry companies. It is intended that private companies will expand proper forest management through better forestry.
- 6) Cooperation with universities provides another form of manpower training.

Recent promotion of forestry and concern about environmental problems have led universities to have forestry courses across the country. Generally, new universities have only poor equipment and insufficient faculties.

Their equipment and staff should be replenished and field practice should be emphasized. By selecting candidates from universities near forest regions, better forest management will be expected. Moreover, forestry courses should be made attractive by giving opportunities for learning outside the country. Thus, it is important to seek better students and produce plenty of capable graduates, who will contribute to the promotion of forestry and proper forest management.

In Brazil, there is such an apprehension that even if the number of students increases, graduates will face much difficulty in securing jobs. Therefore, more weight will be given to qualitative improvement of students than quantitative expansion.

## 7. References (Selected Forestry organizations)

### (1) São Paulo University, Forestry Department

Location: Piracicaba, S.P.  
Teaching staff: 278  
Main subjects: Silviculture, Ecology, Wood Technology  
Student: 25 in one year  
Total: 130 - 150  
Graduating: 18 - 20 in one year,  
More than 80% to private companies  
Master course: Since 1974  
Doctor course: In 1994 (in planning)  
Features: One of the most popular forestry department

### (2) IPEF (of São Paulo University)

Feature: To do research on afforestation and reforestation in cooperation with 23 major forestry companies. One of the best types of cooperation.

### (3) Federal University of Paraná

Location: Curitiba, S.P.  
Teaching staff: 37  
Main subjects: Silviculture, Forestry Management,  
Forestry Ecology, Wood Technology,  
Forestry economics.  
Student: 60 in one year  
Total: 200  
Graduating: 18 - 20 in one year  
80% to private companies  
10% to government officials  
10% to Universities and research institutes  
Master course: Since 1972  
Doctor course: Since 1982

(4) Faculty of Agricultural Science of Pará, Forestry Department

Location: Belém  
Established: Originated in 1945  
1967 Became a university  
1971 Forestry Department  
Teaching staff: 21  
Main area: (1) Environment  
(2) Forestry Management  
(3) Wood Technology  
Student: 50 in one year  
Total: 250 - 300  
Graduating: 40 in one year  
50% to Government, University, Research  
Institute  
50% to Private companies, others  
Master course: Going to INPA  
Feature: Agricultural and forestry research in  
relation to Amazon.

(5) Amazon Federal University, Forestry Department

Location: Manaus  
Established: Originated in 1909  
1988 Became A.F.U. and Forestry dept.  
Teaching staff: 12  
Main subjects:  
Student: 30 in one year  
Total: 80  
Graduating: First Ing. Florestal in 1993  
90% wish to go to private companies.

(6) EMBRAMA (Headquarters)

Feature: Post-graduate training (Master and Doctor) is done in  
Brazil and abroad.  
CNPQ (Curitiba) specializes in forestry.  
CPAC (Brasilia) specializes in the research in cerrado.  
CPAA (Manaus) specializes in Amazon agroforestry.  
CPATU (Belém) specializes in Amazon agriculture and

forestry.

(7) CNPF (One of the EMBRAPA research stations)

Location: Curitiba  
Staff: 45 researchers (Ing.)  
Feature: Specializes in Forestry  
Main Topics: (1) Control of pests of Pinus taeda  
(2) Breeding of forestry seeds  
(3) Caatinga Forestry  
(4) Tissue culture of Eucalyptus and Pinus  
(5) Forestry technique on how to change deteriorated bushland to pine plantation  
(6) Survey on excellent Pino forests  
(7) Breeding and preservation technique on Araucaria angustifolia (Pino)  
(8) Breeding technique on Eucalyptus and Pinus  
(9) Silvicultural technique on indigenous species

(8) CPAC (One of the EMBRAPA research stations)

Location: Brasília  
Research staff: 138 researchers (including 2 foresters)  
Feature: (1) Forestry research accounts for only minor part of the total CPAC activities  
(2) They engage in research of Eucalyptus and Pinus in connection with agriculture, grazing and agroforestry in cerrado areas.

(9) CPAA (One of the EMBRAPA research stations)

Location: Manaus  
Established: 1989  
Research staff: 62 researchers (including 2 foresters)  
Feature: Specializes in Agroforestry, also in rubber and palm

(10) CPATU (One of the EMBRAPA research stations)

Location: Belém  
Established: 1976  
Research staff: Total 137 including 17 foresters  
Main Areas: (1) Natural resources and environment  
(2) Forest resources  
(3) Agricultural production  
(4) Animal production  
Feature: Agriculture and forestry in Amazon

(11) INPA The biggest research institute

Location: Manaus  
Research staff: Total 600 including 40 foresters  
Research areas: Fish cultivation, Botany, Fresh water biology, Endemic disease, Ecology, Meteorology, Entomology, Social science, Forest products processing, Nutrition research, Agriculture, Tropical forestry, Chemistry of natural products  
Feature: (1) Specialize in Amazon research  
(2) Large collection of Amazon specimen

(12) São Paulo Forestry Institute

Location: São Paulo  
Senior staff: 181 (including 19 foresters)  
Feature: Administration, Management and Research of total São Paulo state

(13) CTM of SUDAM

Location: Santarém  
Established: 1957  
Feature: (1) Specializes forestry machinery and forest products processing  
(2) They have a famous Crua-lina Research Forests (Amazon Experiment Forests)





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