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MINUTES OF MEETING  
BETWEEN  
THE JAPANESE MID-TERM EVALUATION TEAM AND  
AUTHORITIES CONCERNED OF  
THE GOVERNMENT OF THE FEDERATIVE REPUBLIC OF BRAZIL  
ON THE TECHNICAL COOPERATION  
FOR THE BRAZILIAN AMAZON FOREST RESEARCH PROJECT PHASE II

At the mid-term stage of the cooperation period of the Brazilian Amazon Forest Research Project Phase II (hereinafter referred to as "the Project"), the Japanese Mid-term Evaluation Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Takashi Fujiwara, visited the Federative Republic of Brazil in order to conduct an overall review and evaluation of the performance of the Project together with the Brazilian members of the joint evaluation meeting.

Interviews were conducted with the project team. There was a series of discussions, field visits and exchanged views.

As a result, both sides and the representative of Ministry of Science and Technology agreed to present to their Governments a summary of the evaluation and recommendations referred to in the document attached hereto.

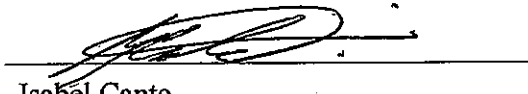
Manaus, 12 June, 2001



Takashi Fujiwara

Leader

Japanese Mid-term Evaluation Team



Isabel Canto

General Co-ordinator for the Amazon  
Programmes

Secretariat for Policies and Programmes  
of Science and Technology

Ministry of Science and Technology

JOINT EVALUATION REPORT  
OF THE BRAZILIAN AMAZON FOREST RESEARCH PROJECT PHASE II  
IN THE FEDERATIVE REPUBLIC OF BRAZIL

1 INTRODUCTION

The Brazilian Amazon Forest Research Project Phase II (hereinafter referred to as "the Project") has been implemented since 1 October, 1998, based on the Record of Discussions (hereinafter referred to as "the R/D"), signed on 20 August, 1998, between the Government of Japan and the Government of the Federative Republic of Brazil.

According to the R/D, the project purpose is to develop basic research on rehabilitation of degraded lands in Amazonian rain forests. Furthermore, the overall goal of the Project is to improve forestry technologies for rehabilitation of degraded lands in Amazonian rain forest areas.

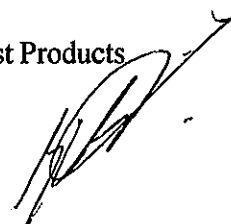
In order to enhance an effective implementation of the Project Type Technical Cooperation, JICA has introduced a project management system called "JPCM" (JICA Project Cycle Management). This is a summary of the intermediate evaluation undertaken on the third year of the project period as a part of the JPCM system.

The mid-term evaluation was carried out by the evaluation teams. In the first step of the evaluation, the teams assessed a degree and prospect of achievement of the project purpose and outputs based on the Project Design Matrix (PDM) and the Plan of Operation (PO) of the Project, which has been prepared before the evaluation. In the next step, the team analyzed and evaluated the Project from the view points of "Effectiveness", "Efficiency", "Relevance" and "Sustainability" in accordance with the JPCM. Finally, the team made a set of recommendations to the Project in order to improve the project design and to make a smooth achievement of the project purpose.

2 MEMBERS OF JOINT EVALUATION MEETING

2.1 Japanese Side

- (1) Mr. Takashi Fujiwara, Leader  
Executive, Independent Administrative Institution, Forestry and Forest Products  
research Institute (FFPRI)



- (2) Dr. Moriyoshi Ishizuka, Distribution Patterns of Forest Types / Natural Forest Dynamics / Seed ecophysiology  
Chief of Department of Plant Ecology, FFPRI
- (3) Dr. Seiichi Ohta, Site Characteristics / Site Adaptability  
Chief of Department of Forest Site Environment, FFPRI
- (4) Ms. Kaori Matsushita, Project Management  
Project Officer, Forestry and Environment Division, Forestry and Natural Environment Department, JICA
- (5) Mr. Hajime Sonoda, Evaluation Analysis  
Researcher, I C Net Cooperation

## 2.2 Brazilian Side

- (1) Dr. Isabel Canto  
General Coordinator of the Amazonian Program, Secretary for Scientific and Technology Policy Program (SEPCT)  
Ministry of Science and Technology (MCT)
- (2) Prof. Dr. Cesar Zucco  
Consultant for SEPCT / MCT , Federal University of Santa Catarina
- (3) Prof. Dr. Christina Dal Pian  
Consultant for SEPCT / MCT, Federal University of Rio Grande de Norte
- (4) Sra. Marilda Goncalves  
Assistant of the Amazonian Program, SEPCT, MCT
- (5) Sr. Marcos Loureiro  
Representative of Dr. Mariza Graca Lima, Coordinator of Received Bilateral Cooperation  
Brazilian Cooperation Agency

## 3 OBJECTIVE OF THE EVALUATION

Main objectives of the evaluation of the Project are as follows:

- (1) To conduct a comprehensive evaluation of the achievement in accordance with the original plan described in the R/D, Tentative Schedule of Implementation (TSI), PDM and PO, and
- (2) To make a recommendation and suggestion to the Project team regarding future

project activities and necessity of amendment of the project design at the intermediate evaluation stage.

#### 4 METHODOLOGY OF EVALUATION

##### 4.1 Evaluation procedures

In order to collect data and information for evaluation, the Japanese evaluation team carried out field survey in the project sites and also made interview with the Brazilian counterparts engaged in the Project, Japanese Experts, and other relevant government agencies during 6 to 8 June 2001.

Based on an analysis on the evaluation items as shown below, a draft evaluation report was prepared by the Japanese evaluation team on 9 June, 2001.

A joint evaluation meeting was held on 10 and 11 June, 2001 to finalize the evaluation report. During the meeting, both Japanese and Brazilian evaluation teams conducted additional interviews to the Brazilian counterparts and Japanese experts. Both teams made intensive discussions to examine and finalize the joint evaluation report.

##### 4.2 Items of the Evaluation

###### 4.2.1 Accomplishment of the Project

Accomplishment of the Project was measured in terms of inputs, activities, outputs and project purpose, all of which accord with the R/D, TSI and PDM.

###### 4.2.2 Analysis on Evaluation Criteria

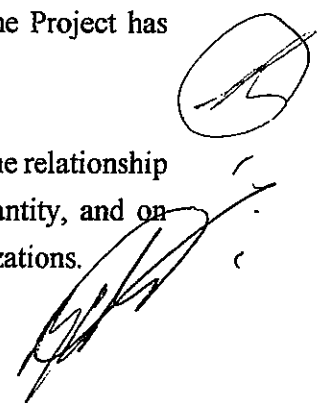
###### (1) Effectiveness

Effectiveness was assessed by evaluating the extent to which the Project has achieved outputs and project purpose.

###### (2) Efficiency

Efficiency of the project implementation is analyzed focusing on the relationship between outputs and inputs in terms of timing, quality and quantity, and on linkage with other cooperation schemes of JICA and other organizations.

###### (3) Relevance



Relevance of the Project was reviewed in terms of the validity of the project purpose and overall goal in connection with the development policy of the Government of the Republic of Brazil and needs of the beneficiaries.

(4) Sustainability

Sustainability of the Project was analyzed in organizational, financial and technical aspects by examining the extent to which the achievement of the Project is to be sustained or expanded after the assistance is completed.

5 RESULTS OF EVALUATION

5.1 Accomplishment of the Project

5.1.1 Accomplishment of inputs

(1) Japanese side

(a) Experts

i. Long-term experts

Seven (7) long-term experts in total have been dispatched, and the fields of experts dispatched are as follows:

- Chief Advisor
- Coordinator
- Distribution Patterns of Forest Types
- Natural Forest Dynamics and Site Adaptability

ii. Short-term experts

Eleven (11) short-term experts have in total been dispatched, and the fields of experts dispatched are as follows:

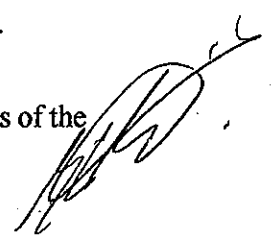
- Distribution Patterns of Forest Types
- Natural Forest Dynamics
- Site Characteristics
- Site Adaptability
- Project Cycle Management

(b) Provision of machinery and equipment

The machinery and equipment worth approximately 105 million Japanese yen in total have been provided to the Project by JICA at the time of evaluation.

(c) Training of Brazilian Counterpart personnel in Japan

Six (6) Brazilian counterpart personnel were trained in Japan. The subjects of the



training courses are as follows:

- Natural Forest Dynamics
- Site Characteristics
- Site Adaptability

(d) Budget allocation

For the smooth implementation of the Project, a total of 36.6 million Japanese yen has been allocated to supplement a portion of local cost expenditures, including cost of afforestation promotion program.

(2) Brazilian side

(a) Appointment of counterparts and other personnel

Approximately twenty-seven (27) counterpart personnel in total have been appointed for the Project. Other supporting staff have been also assigned for the Project, such as drivers, secretaries, etc.

(b) Financial support by MCT

R\$ 310,000.00 has been allocated as operational cost for the Project.

1998 R\$100,000.00

1999 R\$150,000.00

2000 R\$60,000.00


(c) Provision of land, building and facilities

The following facilities have been provided for the Project:

- Land for the experimental plot
- Land for the experimental sites
- Project office and related facilities

5.1.2 Accomplishment of Activities

Most of the activities in each component have been implemented as planned in PO. The accomplishment is summarized in the Annex.



### 5.1.3 Accomplishment of Outputs

#### Output 1: Distribution Patterns of Forest Types

Updated information on land cover and land cover change are available.

This component aims to develop classification and change detection of land cover, especially forests and degraded areas, by remote sensing technology. Basic hardware and software were fully installed in the early stage of Phase II.

A classification of forest types and degraded area in Manaus area was done using satellite imagery of Landsat TM (Thematic Mapper) and imagery of JERS-1 (Japanese Earth Resources Observation Satellite -1 Synthetic Aperture Rader). A new algorithm was introduced to extract the advantage of both Landsat TM and JEFRS-1 imageries. The classification of forest type and degraded areas was updated and land cover change was detected in Manaus area in the period of 1986-1997.

In order to remove distortions of raw spectral values of Landsat TM pixels due to luminosity aberrations induced by topography, a visible-topography removal model was developed. This model applied statistics of principal component on a multi-spectral image and was effective to remove the relief effect of slopes.

Long-term tree crown images were collected for two years continuously. Optometric database of crown images were in initial development.

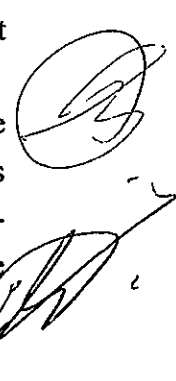
The results of classification and change detection of forest and degraded area in Manaus area was presented at the Mid-term Workshop of the Project held in September, 2000, and an abstract was published. The results of relief removal technique for improvement in spectral classification were also presented at the Mid-term Workshop and an abstract was published.

#### Output 2: Natural Forest Dynamics

The understanding of the natural forest dynamics is increased.

This component aims to clarify the structure and dynamics of natural forest for better understanding of the process of forest formation and its role in the ecosystem functioning, which are essentials to define strategy for the sustainable forest management and/or rehabilitation of degraded forest area as well.

Two transects (20 m x 2500 m in each) oriented by E-W and N-S directions were established in INPA Experiment Forest (ZF-2) in Phase I. Three topographic conditions (plateau, slope, floodplain) were recognized along these transects. In Phase II, 52 sub-quadrates (1 m x 4 m) were randomly set in these transects for measurement of tree





species.

Direct sowing of 10 forest tree species was examined on various sites with different degree of perturbations. The best results were found on the bare soil site but only very large seeds such as *Caryocar villosum* and *Parkia multijuga* established satisfactory seedlings. The influence of seed size on predation and seedling establishment of *Carapa guianensis* and *C. procera* were studied in three forested areas. It was found that germination speed and establishment of seedlings were not influenced by seed size.

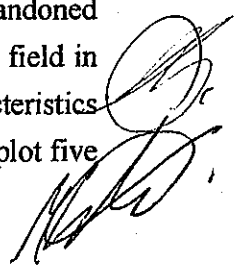
An article on seed management (botanic, ecological and technical aspects) for *Carapa guianensis* and *C. procera* was submitted to Acta Amazonica. Three articles on the effect of temperature and/seed coat permeability on seed germination were published (*Maquira sclerophylla*, *Hymenaea coubaril*, *Ceiba pentandra*). Two monographs of B.Sc degree were supervised. An article on influences of different temperature on seed germination of *Clarisia racemosa* was submitted. An article on direct sowing comparing sites with different degrees of perturbation was accepted. Results of the studies were presented at 9 scientific events and 21 abstracts were published.

#### Output 5: Site Adaptability

Seedling growth response to different environmental conditions is clarified for rehabilitation of degraded areas in Amazon.

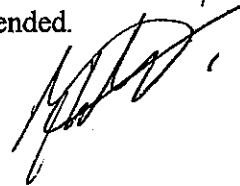
Various studies have been conducted to develop new techniques to produce seedlings of indigenous tree species of Amazonian rain forests. Important information was obtained for the germination of *Aniba rosaeodora* seed and on the method to break dormancy of *Ochroma lagopus*. Valuable data were accumulated on the effects of various factors such as substrate, fertilizer, shading intensity, root pruning and types of container on seedling growth of selected indigenous species as *Cedrela odorata*, *Vouacapoua pallidior*, *Aniba rosaeodora*, *Ceiba pentandra*, *Enterolobium schomburgkii*, *Vouacapoua pallidior* and *Ochroma lagopus*. Also the possible methods to produce seedlings of *Aniba rosaeodora* by wilding and cuttings were demonstrated. The data are being stored in database. Twelve abstracts on seedling production technology were presented in scientific meetings. The information obtained will contribute to the development of technology of seedling production by indigenous tree species in Amazon.

Twelve and three ha of experimental plantations were established in abandoned pasture in Presidente Figueiredo – Santa Claudia and in abandoned agricultural field in CAMES, respectively, to construct the fundamentals to clarify the growth characteristics of indigenous tree species planted in degraded area. In the former experimental plot five



climax or intermediate Amazonian indigenous tree species, *Carapa guianensis*, *Swietenia macrophylla*, *Hymenaea courbaril*, *Dipterix odorata* and *Cedrela odorata*, were planted mixed with pioneer species of *Ochroma lagopus* with and without tillage treatment. In the latter experimental plots the effects of charcoal application and mixed planting with nitrogen fixing leguminous trees have been examined for *Aniba rosaeodora*, *Swietenia macrophylla* and *Hymenaea courbaril*. Also the growth of *Aniba rosaeodora* planted under different light conditions in the field has been monitored. Important data on the growth characteristics of nine indigenous tree species planted in degraded are being accumulated. Growth data are being collected continuously also from experimental plantation established in an abandoned agricultural field at Presidente Figueiredo – Serraria during Phase I of the Project. All the data are being stored in the form of database.

Five abstracts on growth characteristics of indigenous tree species were presented in scientific meetings. The data and findings on growth characteristics obtained by above-mentioned studies will contribute to the development of silvicultural techniques of indigenous tree species. However, the number of species studied is still limited. The Project is expected to implement the additional planting experiments, and to cover larger number of species in order to achieve the project purpose. Also to increase publications of research articles in scientific journals is strongly recommended.



## 5.2 Analysis on Evaluation Criteria

### 5.2.1 Effectiveness

As described in the previous section, the Project is achieving the Project Purpose in a good extent. Interim results in each field are summarized below. Tasks and / or efforts required to effectively achieve the Project Purpose are also described.

If the on-going and planned researches are completed as scheduled by the end of the project period, the Project will bring about a lot of biological and ecological information that will help developing technologies for forest conservation and rehabilitation of degraded areas in Amazon.

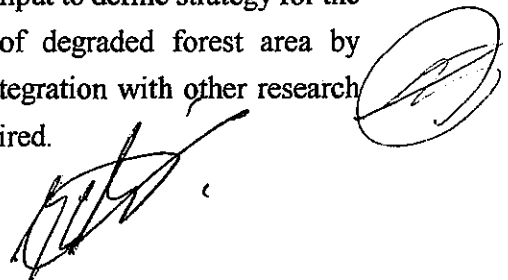
In the course of attaining its purpose, the Project is also playing an important role in research capacity building. Firstly, equipment and facilities provided by the Project enabled INPA to increase its research capacity. Secondly, by increasing an involvement of graduate / undergraduate students to research activities, the Project is making important contribution in human resource development for forest research in Amazon.

#### Research Field 1 : Distribution Patters of Forest Types

A new algorithmic approach was employed to improve remote-sensing techniques in classifying and mapping vegetation. A land cover map of the Manaus area with a detailed vegetation classification was produced using these techniques. This technology has potential to enable a remarkable progress in detailed detection of degraded forests. As one of the remarkable outputs in the initial stage, it also played a significant role to increase publicity of the Project in Brazil. From the viewpoint of technical transfer to the Brazilian side, further improvement of techniques, completion of operational manuals and increased capacity in the Brazilian side is necessary.

#### Research Field 2 : Natural Forest Dynamics

Experimental plot was established for long-term monitoring of primary forest dynamics in order to clarify the structure and dynamics of natural forest. Data and information from experimental forest is being accumulated on ecological characteristics of indigenous tree species. This information is an essential input to define strategy for the sustainable forest management and / or rehabilitation of degraded forest area by indigenous species. To attain useful information, better integration with other research fields, data storage, processing, and result analysis are required.

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### Research Field 3 : Site Characteristics

Data collection on physical and chemical characteristics of soils of various types of vegetation was completed by some 50%, and the comparative analyses with those at primary forest is on-going. These analyses are essential to establish site classifications of degraded areas to be used for determining site adaptability of various tree species. They also provide basic information for technical development on soil management technologies for degraded area. In order to attain effective results by the end of project period, adequate number of researchers and good maintenance of laboratory equipment are necessary.

### Research Field 4 : Seed Ecophysiology

With an aim of developing appropriate seed handling techniques, seed ecophysiological data is being collected for 60 indigenous species in Amazon out of 150 species that are known as industrially important. Data on 3 species were presented in scientific papers. This information is essential to collect, store, germinate seeds for large-scale seedling production, and eventually enable to increase the number of indigenous tree species for afforestation<sup>2</sup>. Continuous efforts to guarantee seed collection will permit data collection as scheduled and will secure effectiveness of this component.

### Research Field 5 : Site Adaptability

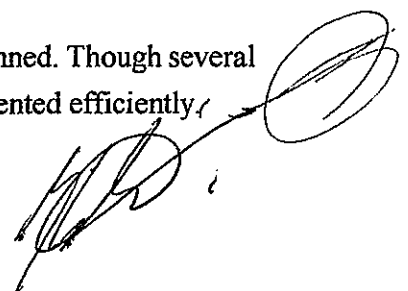
Growth response of seedlings to environmental factors are being tested for 8 species. Field trials are being conducted for 11 species to find out growth characteristics of each species and appropriate planting methods including mixed planting and different land preparation method. These results will be useful to find out suitable techniques for producing seedlings of indigenous species and develop silviculture system suitable for degraded area in Amazon. In order to implement the additional planting trials scheduled in the remaining project period, good maintenance of equipment and adequate number of field personnel to establish and maintain the experimental plots are required.

#### 5.2.2 Efficiency

In general, the Project has been carried out smoothly as planned. Though several constraints and weakness are observed, the Project is being implemented efficiently.

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<sup>2</sup> Afforestation: Planting trees on land other than forested land.



### Assignment of Researchers

Both Japanese and Brazilian researchers assigned for the Project have enough academic background and specialized knowledge. In addition, by involving graduate and undergraduate students to the research activities under the Project, enough number of researchers were assigned for most of the five research fields.

Activities of the Research Field 1 (Distribution Patterns of the Forest Types) had several constraints in this respect. INPA recruited two technicians quickly in the beginning, but could not find additional researchers for this field. The main counterpart researchers could not fully participate to the Project due to a health problem. The Japanese long-term expert for this field had to spend a lot of time to fix and tune-up the equipment in the GIS Laboratory during the first year of his two years' assignment and had to leave without compiling a technical manual. As the result, technical transfer to the Brazilian side remained as a minimum, and is planned to be carried out through additional assignment of Japanese short-term experts and training in Japan.

### Training in Japan

For the most cases, training in Japan has been very effective, and its fruits are well utilized for the researches under the Project.

### Equipment and Facilities

Important equipment was provided mainly for the Research Fields 1, 3, 4. The equipment has been fully utilized for the research activities. While the quality and quantity of the equipment was mostly adequate, arrival of the equipment was not always timely, due to delay in finalizing specifications and customs clearance.

For the most of laboratory equipment, operation and maintenance has been troublesome because of various reasons such as unstable power supply, high humidity, inadequate water quality, limited availability of technical services and spare parts at Manaus. A lot of time and money had to be spent to restore the equipment. The problem of power supply was partially solved by no-brakes and will be mostly solved soon by installing a generator. Nevertheless, the maintenance problem will remain as the major obstacle for research activities unless proper measures are taken. The maintenance of the laboratory equipment by Brazilian side would be facilitated by providing technical advices and information on maintenance services from Japanese side.

Experimental plots / sites were established for the Research Field 2 and 5. It took long time to find adequate land to establish experiments sites at degraded areas. Nursery established in the previous phase was expanded.

### Budget

The Special Measures (afforestation promotion program) taken by the Japanese side provided essential budget to establish and operate the nursery and the experimental sites.

Brazilian side has been making efforts to increase the amount of counterpart budget. However, the provided counterpart budget from MCT could have been better utilized if it had been available early in the year.

### Management and Collaboration

Overall project management has been good in administrative or operational aspect, but rather weak in technical aspect.

Monthly meetings functioned well to decide on various administrative / operational matters. However, there has been limited opportunity to share scientific data / information project-wide and discuss on integration of research activities. It is necessary to promote deeper integration among the five research fields of the Project.

### Others

Since the number of workers for field works is not sufficient, enough number of seeds of some species can not be collected to conduct field trials.


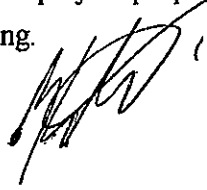
### 5.2.3 Relevance

#### Overall Goal and Project Purpose

Conservation and rehabilitation of tropical rain forest in Amazon has been among the top priority of the Brazilian government. As the countermeasures to continuous decrease of forest resources, the Government has introduced a series of policies such as sustainable use of forest resources (Decree 1282, 1994), forest deposition and obligatory forestation (Brazilian Forest Code, Art 20/21), and subsidized credit scheme for the projects that rehabilitate degraded area (IN001/MMA/96, Brazilian Forest Code, Art 19/20/21).

In line with these policies, there is an increasing need to develop practical techniques to plant trees, among others economical trees in Amazon.

Thus, the overall goal and the project purpose are highly valid. Necessity and importance of the Project remain strong.



### Overall Project Design

In Brazil, although afforestation activities of introduced species have a long history, plantation of indigenous trees has limited experiences. Therefore, in order to develop effective techniques for establishing ecologically sound plantation by using indigenous trees, basic knowledge on primary forest has to be accumulated in the first place.

In this respect, the Project is adequately designed in a comprehensive manner to cover most of the essential research fields for forest conservation and rehabilitation of degraded areas in Amazon.

### 5.2.4 Sustainability

#### Technical / Human Resources Aspects

High sustainability in technical aspect is expected in most of the fields, since researchers in INPA has sufficient capability to continue and develop research activities after the Project. Research capacity of INPA is expected to remain strong if the involvement of graduate / undergraduate students continues.


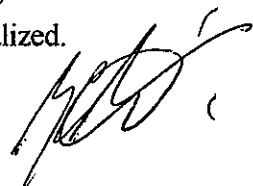
In the Research Field 1 (Distribution Patters of Forest Types), if technical transfer is completed during the remaining project period by means of training and assignment of additional short-term experts, INPA will be able to apply the new techniques. However, in order to enable INPA to make further technical development by itself, additional highly qualified specialist in this field is necessary.

#### Financial Aspect

Sustainability of research development at INPA depends heavily on availability of financial resources. If continuous external support is secured, sustainability of the Project will be attained.

#### Institutional Aspect

With its long history and established scientific position, INPA has sufficient institutional sustainability as a leading institution for basic research of tropical rain forest in Amazon. On the other hand, as far as the Project is concerned, it was observed that the exchange of scientific information with external organizations is rather limited and largely conducted on personal basis but not institutionalized.



## 6 CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Conclusions

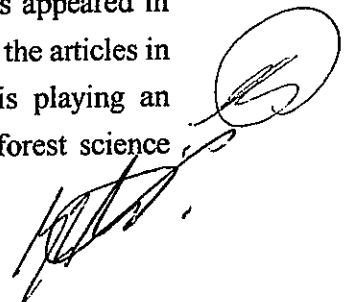
#### (1) Importance and originality of the Project

The unique feature of the Project is to pursue both economically and ecologically sound way of rehabilitation of degraded lands based on the comprehensive research on Amazonian rain forests by INPA, to reduce the exploitation pressure against the primary forest. Basic analysis of distribution patterns of forest types, natural forest dynamics, site characteristics and seed ecophysiology will be integrated all together into the experimental research to validate the site-species matching and planting methods. The Project embodies the concept of sustainable forest management to meet social, economic, ecological and other needs for present and future generation, advocated in the "Forest Principles" of the United Nations Conference on Environment and Development (UNCED), held 10 years ago in Brazil. From those backgrounds, the Project was positioned as an associated project of the Pilot Program to Conserve the Brazilian Rain Forest (PPG7), which was internationally set up for conservation and sustainable management of Brazilian rain forest.

#### (2) Basic accomplishments

Five research fields described in the R/D are being implemented successfully. Fundamentals for long-term monitoring of primary forest and plantation were securely constructed by establishing experimental plots. Also the fundamental facilities and equipment as a basis for research of remote-sensing, soil science, seed ecophysiology and so on were established and being maintained in a good condition so far by solving some technical problems.

An important step was made for improving remote-sensing technology that enables them to detect and classify degraded area with higher accuracy. Every research field is producing and accumulating valuable information on primary forests, soils, seeds, seedlings and plantations of indigenous species smoothly. Research achievements were presented in scientific articles, abstracts of scientific workshop and also in the forms of thesis by the students involved. However, the number of research articles appeared in scientific journals is still limited. Further efforts should be made to publish the articles in internationally recognized scientific journals. In addition, the Project is playing an important role in contributing to the human resources development in forest science





research in INPA through the Project's activities.

It is concluded that the Project will be able to provide enormous amounts of biological and ecological information on Amazonian rain forest by the end of the Project, which will contribute to developing technologies for its sustainable management and rehabilitation, if the Project activities proceed as scheduled.

## 6.2 Recommendations

### (1) To enhance dissemination of the research results

In order to attain wide use of the research results, it is important to produce concrete research outputs and disseminate them in a useful form for wide range of potential users, such as academic society, national / local government institutions, private investors to afforestation, NGO and farmers in Amazon area. To accelerate information dissemination, the Project is encouraged to use every opportunity including seminars, workshops, scientific papers and articles, web-sites, etc.

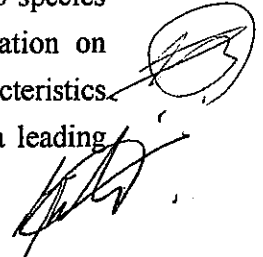
### (2) To strengthen linkage between Pilot Program to Conserve the Brazilian Rain Forest (PPG7) and other related programmes

It is indispensable to collaborate and share knowledge with PPG7 in order to achieve the overall goal of the Project.

Some organizations in the Amazon area are implementing scientific research concerning rehabilitation of degraded areas in different ways. Presently, some individual research staff has scientific information exchanges with each other, however, it is necessary to have more systematic and organizational cooperation with the related organizations, such as Brazilian Agricultural Research Enterprise (EMBRAPA), Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) and Institute of Agricultural and Livestock Development of the State of Amazon (IDAM), in the remaining project period.

### (3) To implement additional planting experiments

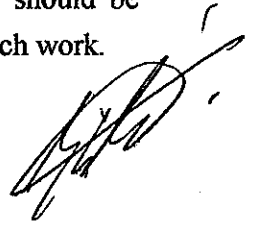

It is required to develop technologies of establishing ecologically sound tree plantation by using Amazonian indigenous tree species, which counts 50 – 150 species even only for commercially valuable trees. However, knowledge accumulation on indigenous tree species is still limited, although the information on growth characteristics for around ten species is being accumulated through the Project. INPA, as a leading



research institute in Amazonian research, is expected to cover further information about as many species as possible. In this regard, it is recommended that the Project implements additional planting experiment for site-species matching and planting methods with reasonable number of species in the remaining project period in order to achieve its purpose.

(4) To encourage scientific discussions among the Project team

As mentioned in 5.2.2, it is necessary to share information among the Project team for further integration of the Project activities. Scientific committee should be implemented to strengthen scientific discussions and integration of the research work.

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Achievement chart of activities (Component 1 - Distribution patterns of forest types)  
FY (April to March)

Activities	FY (April to March)												Expected final results		
	1998	1999	2000	2001	2002	2003	Achievement								
Field 1: Distribution Patterns of Forest Types	Output / Target Output : Updated information on land cover and land cover changes are available.														
1-1. To classify forest types by using remote sensing ("RS") technology														1 Revised vegetation map in the Manaus area with detailed classification was done using new algorithm. 2 One (1) abstract was presented at the Mid-term Workshop.	Completed
1-2. To classify degraded area by using RS technology														1 Same as above.	Completed
1-3. To detect land cover changes by using RS methodology														1 Land cover change evolution maps in Manaus area are available for the period 1986-97.	Same as Output / Target
1-4. To develop methodology to improve classification accuracy and to detect land cover														1 Methodology for relief removal of satellite imagery was developed. 2 One (1) abstract was presented at the Mid-term Workshop.	Scientific papers and technical manual
1-5. To improve methodology of evaluating distribution and seasonal changes of trees by using proximal RS														1 Long-term series of time lapse tree crown pictures are available.	Scientific papers and technical manual

Achievement chart of activities (Component 2 - Natural forest dynamics)  
FY (April to March)

Activities	1998		1999		2000		2001		2002		2003		Achievement	Expected final results
	III	IV	I	II	III	IV	I	II	III	IV	I	II		
Field 2: Natural Forest Dynamics														
Output : The understanding of natural forest dynamics is increased.														
2-1. To clarify distribution patterns of main tree species growing under different environmental and topographical conditions													1 9 ha quadrat was established on plateau in ZF-2.	A complete report on distribution pattern of selected tree species will be presented including species diversity, seedling densities under different environmental and topographical conditions.
2-2. To clarify natural regeneration process of main tree species growing under different environmental and topographical conditions.													2 1 (one) report was published. 1 Fifty-two (52) sub-quadrates (1 m by 4 m) were randomly established for small sized tree (<10 cm in dbh) measurements along the two transects (E-W and N-S)	A report on natural regeneration dynamics will be presented including seedling densities, species diversity, mortality and recruitment rates under different environmental and topographical conditions.
2-3. To clarify relationship between growth rates of some selected trees and environmental conditions													2 Characteristic of tree species compositions including seedlings were compared on two different topographical conditions (plateau and floodplain). 3 Five (5) abstracts were published.	
Target : Research papers concerning natural forest dynamics in the Amazon													1 Based in the inventory of the two transects carried out in 1996 and repeated in 2000, tree mortality and recruitment during this period were revealed. 2 Seasonal growth patterns of tree stems were evaluated using metal dendrometer band. 3 Two (2) MSc thesis were completed and two (2) posters were presented in an international meeting.	Transects will be re-measured in 2002. The relation of environmental factors to seasonal stem-growth patterns will be analyzed. A paper dealing with natural forest dynamics will be ready by the end of the Project.

Note : Period of activities 2-1 was extended to the end of the Project.

Achievement chart of activities (Component 3 - Site characteristics)  
FY (April to March)

Activities	Output / Target	1998					1999					2000					2001					2002					2003					Achievement	Expected final results
		III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV						
Field 3: Site Characteristics	Output : Characterization of different sites in natural forest and in plantations area is improved.																											Seven (7) abstracts, 1 (one) BS and three (3) reports					
3-1. To compare soil chemical properties in the sites of primary and secondary forests, degraded areas and plantation over degraded areas	Target : Research paper and database comparing soil chemical properties of primary and secondary forests and plantations on degraded areas																												1 Data collection on soil chemical properties under primary and secondary forests, plantation on degraded land and old plantations are in progress.	Same as Output / Target			
3-2. To compare soil physical properties and temperatures of sites in primary and secondary forests, degraded areas and plantation over degraded areas	Target : Research paper and database comparing soil physical properties of primary and secondary forests and plantations on degraded areas																												1 Instruments for monitoring soil moisture conditions and soil temperature were installed in primary and secondary forests and experimental plantations and monitoring data are being accumulated.	Same as Output / Target			
3-3. To undertake nutritional characterization of selected tree species	Target : Report and research paper describing nutritional status of tree species in necessary primary forest and plantation																												1 Plant body samples of five (5) tree species were collected for chemical analyses.	Same as Output / Target			
3-4. To establish relationship between tree distribution patterns and soil site characteristics in primary forest	Target : Research paper concerning site influence on tree distribution																												1 Nutrient distribution in soils and physical properties along transects plots in primary forests were collected. The data were compiled in the form of database.	Completed			
3-5. To establish relationships between the growth of selected tree species and main soil site characteristics in plantation over degraded areas	Target : Research paper concerning site influence on growth of plantations on degraded areas																												1 Data on soil physical and chemical characteristics of plantation on degraded land are being collected in the activities of 3-1 and 3-2. Data on tree growth are being collected in the Component 5.	Same as Output / Target			

**Achievement chart of activities (Component 4 - Seed ecophysiology)**

FY (April to March)		1998	1999	2000	2001	2002	2003	Achievement	Expected final results
Activities	Output / Target	III	IV	I	II	III	IV	I	II
Field 4: Seed Ecophysiology	Output : Main seed characteristics necessary for seed management of important species for forest conservation and the reforestation of degraded areas are known.								
4-1. To describe biometry and morphology of fruits and seeds and to describe seed extraction methods	Target : Database of 60 forest species and a handbook of seed management of 7-10 forest species as common to 4-1., 4-2 and 4-3.							<ol style="list-style-type: none"> <li>Thirty-five (35) species were described for seeds and fruits.</li> <li>The results of three (3) species were summarized for scientific papers and for a handbook.</li> <li>One (1) article was submitted to Acta Amazonica</li> </ol>	Database of sixty (60) species will be completed. The results of 7-10 species will be summarized into a handbook. Seed reserves will be determined hopefully for twenty-five (25) species.
4-2. To determine requirements for seed germination	Target : Database of 40 forest species							<ol style="list-style-type: none"> <li>Twenty-eight (28) species were done for determination of dormancy and germination rate under the standard condition.</li> <li>Germination rates of eleven (11) species were determined under different temperature conditions</li> </ol>	Same as Output / Target
4-3. To classify seeds in relation to storage behavior	Target : Database of 25 forest species							<ol style="list-style-type: none"> <li>Fifteen (15) species of seed storage behavior were clarified. Seed can be classified into three large groups: orthodox, recalcitrant and intermediate seeds</li> </ol>	Same as Output / Target
4-4. To determine tolerance to desiccation and low temperature stress of non-orthodox seeds	Target : Reports summarized in the form of Master degree and Ph.D thesis and scientific publications (common to 4-4. And 4-5. )							<ol style="list-style-type: none"> <li>Three (3) articles were published, one (1) article was submitted, two (2) monographs BSc were completed.</li> <li>Discussion of results with experts of other institutions in nine (9) scientific events, a total of twenty (20) abstracts published</li> </ol>	Same as Output / Target
4-5. To gather information about longevity of seeds after dispersal in natural and disturbed environments	Target : Same as above							<ol style="list-style-type: none"> <li>One (1) article on a study of direct sowing for ten (10) species was accepted for Restoration Ecology</li> <li>Perdition and germination of two (2) species were studied and presented at the Mid-term Workshop.</li> </ol>	Same as Output / Target

Achievement chart of activities (Component 5 - Site adaptability)  
FY (April to March)

Activities	FY (April to March)						Achievement	Expected final results
	1998	1999	2000	2001	2002	2003		
Field 5: Site Adaptability	III IV I II III IV I II III IV I II III IV I II	III IV I II III IV I II III IV I II III IV I II	III IV I II III IV I II III IV I II III IV I II	III IV I II III IV I II III IV I II III IV I II	III IV I II III IV I II III IV I II III IV I II	III IV I II III IV I II III IV I II III IV I II		
Output / Target Output : Planting techniques including seedling production is improved for rehabilitation of degraded area in Amazon.								
5-1. To clarify seedling responses to environmental factors							1	Twelve (12) abstracts were presented at the Mid-term Workshop; Seedling responses of eight (8) indigenous species against substrates, fertilizer, shading and soon elucidated.
5-2. To clarify growth characteristics of seedlings planted in degraded areas							1	Five (5) abstracts were presented at the Mid-term Workshop; (1) effect of mixed plantation in combination of climax or intermediate and pioneer species and tillage practice on seven different indigenous tree species planted in degraded land are being monitored, (2) effect of charcoal application and mix-plantation with nitrogen fixing trees are being assessed.
							2	Two (2) experimental sites were established.
Target : 1) A research paper including the table concerning growth and survival rates of seedling planted in degraded areas								Data collection on growth characteristics with different planting methods including mix-planting for large number of indigenous tree species are targeted by establishing additional experimental plantation in the rest of the project period.
2) Experimental sites established in degraded area								
3) Database of research results with seedlings in nursery and plantation								