

NO. 100

**REPORT BY THE SURVEY TEAMS
ON
THE JAPANESE TECHNICAL
COOPERATION PROJECT
FOR
THE FORESTRY RESEARCH
IN
SAO PAULO, BRAZIL**

December 1973

JAPAN INTERNATIONAL COOPERATION AGENCY

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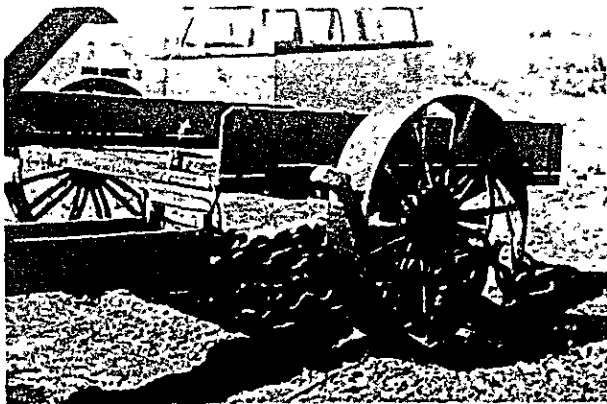
Photos

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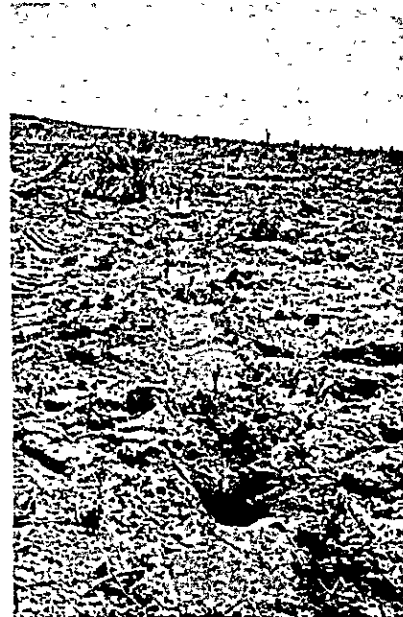
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1. Discussions between the executive staff of the Forest Institute of São Paulo State and the Preliminary Team.



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3. Potted Elliott pine seedling and planted in the holes made by the putting machine.



4. Elliott pine tree of two years after planting. The tree grows well in the less fertile CERRADO soil.



5. A beautiful forest 15 years after planting. Note the impressive growth of natural seedlings in open places.



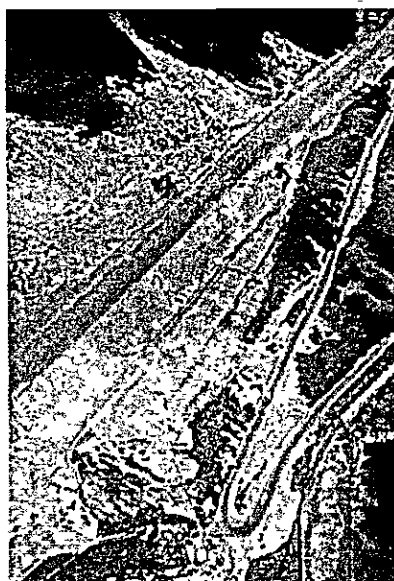
6. An aerial view of the State of São Paulo.



7. A coffee plantation developed several decades ago was abandoned for grazing as the land had become sterile. It has since been so devastated that even grasses cease to grow there today.



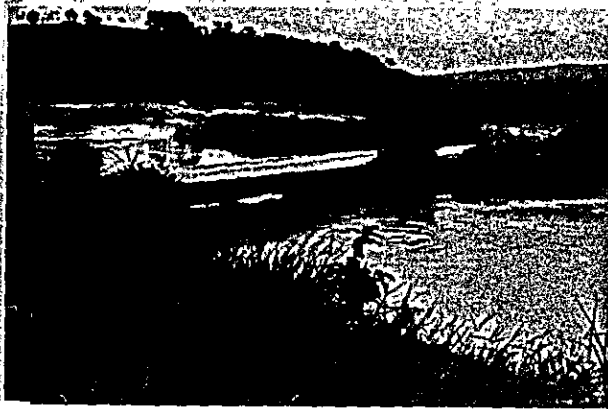
8. The downstream area is flooded at every heavy rainfall. The Paraiba watershed.



9. Road building posing another problem from the watershed management standpoint.



10. Surface erosion is accelerated recently, causing a collapse of the bank as seen in the plot. Note that no erosion develops in the forested sector.



11. The City Government of Taubate spends a large amount money to purify the red, muddy water of the river. The upstream area of the Paraiba.



12. Coastal mountains. Surface landslide seen on the slope of granite. The upstream area of the Paraiba.



13. Gullies developing in the coarse grazing land. The upstream area of the Paraiba.



14. Tree of Brazil. The barks used to be used for dye manufacture. The country is named after the tree, but there are not so many of them growing today.



15. Signing of the Record of Discussion.

PREFACE

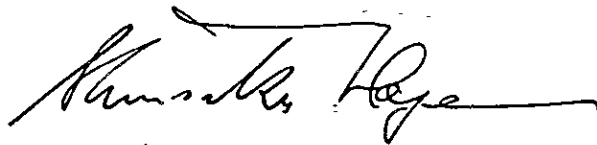
The Government of Japan has decided to start the Japanese Technical Cooperation Project for the Forestry Research in São Paulo, the Federative Republic of Brazil, as the second technical cooperation project in the field of forestry following the "Performance Trails for Reforestation in Amazon" and entrusted the Japan International Cooperation Agency to conduct the project. This report is based on the results of survey conducted by the JICA in the course of the planning of the Project.

In the State of São Paulo the greater part of its forest area has been destroyed as a result of the development of coffee plantations in the past 60 years. Soil conservation and water source development are now major problems there. In such circumstances, the launching of the technical cooperation project concerning watershed management, water and soil conservation and other related matters are regarded as highly significant.

This report contains the results of the survey made from April 5 through 22, 1978, by the preliminary Survey Team led by Dr. Hidenori Nakano, Director, Forest Influences Div., Forestry and Forest Products Research Institute, Ministry of Agriculture, Forestry and Fisheries, and of the survey by the Implementation Survey Team also headed by Dr. Nakano dispatched for 14 days from November 25, 1978. I hope that this report will prove to be useful for the development of the project and will contribute to the promotion of joint efforts in the forestry field between Japan and the Federative Republic of Brazil.

I wish to express my sincere thanks to the authorities and people concerned of the Federative Republic of Brazil for their great assistance extended to the survey teams.

December, 1979



Shinsaku Hogen
President
Japan International Cooperation Agency

I. Preliminary Remarks

1. Project background

- (1) When he attended the World Forestry Conference in Argentine in 1971, Dr. Hideo Takehara, the then Director of the Forestry & Forest Products Research Institute, was solicited by Dr. Yamazoe, São Paulo Forest Institute, who was also at the conference, for Japanese cooperation in the field of forestry studies and research.
- (2) In 1972 Dr. Walter of the São Paulo Forest Institute came to Japan to learn disaster prevention techniques from Dr. Nakano, the then Chief of the Forestry Conservation Section, Forest & Forest Products Research Institute. He earnestly asked Dr. Nakano to come to Brazil for on-site instructions before his return to the country. Later in June, 1975 an official Brazilian request for the dispatch of experts was filed with the Japanese side.
- (3) In compliance with the request, Dr. Nakano, Director of Forestry Influences Division, was dispatched to the São Paulo Forest Institute in January, 1976, where he gave the Brazilian staff guidance in watershed management in general for two months.

The following problems were exposed as a result of Nakano's review of the local situation.

- i. Soil erosion and washout due to road building, soil erosion and washout in grazing grasslands, large uncontrolled run-offs of soils and organic matters in billy areas suffering from soil erosion, lands turned into housing lots, farmlands and others, and growing signs of river pollution due to the inflow of industrial (pulp plant) and urban waste waters and agricultural chemicals from farmlands in some districts are observed. Almost none of these problems develops in the narrow coastal district between Santos and Rio de Janeiro, where conserved occupies the greater part of the watershed natural forests.
- ii. Being industrialized more extensively from year to year, the district along the São Paulo - Rio de Janeiro highway is becoming more significant to the Federative Republic of Brazil. However, floods rising from branches of the Paraíba

flowing are estimated to be escalating in volume and scale every year. The volume of flood discharge is also rising year after year.

- iii. The forest area accounted for 82% of the total area of the State of São Paulo (248,000 Km²) in the 1850's, if it was limited to that of wild silvas. As of 1973, the figure stood at approximately 20% (natural forests: 8.3%, artificial plantations: 2.6% and shrub-scattered areas: 9.2%). There has been a drastic reduction in the forest area in the State of São Paulo over the past 100 years.
- iv. Up to 1970 the major task of the São Paulo Forestry Institute had been to develop model plantations in various parts of the country. In 1970, however, its organization was revised so that it becomes to have a function as a research institution as well. The augmenting its functions is urgently required in order to promote the development of forestry technology for the optimum watershed forest management.

During Dr. Nakano's stay in Brazil, the officials concerned of the São Paulo Forestry Institute repeatedly expressed their wishes for Japanese cooperation on a project basis.

- (4) In compliance with another request for the dispatch of experts, the following experts four were sent to the São Paulo Forestry Institute: Kobata (cooperation planning, staying there for one month), Endo (watershed management, two months), Konuma (forestry machinery, two months) and Ishizaki (forestry conservation, one month). They worked together with the Brazilian staffs in their respective fields and were solicited for more extensive cooperation on a broader scale in the future before their return to Japan. The concrete fields of cooperation proposed by the São Paulo Forestry Institute at that time were almost identical to the seven fields, which are described in the "Contents of solicitation" in 2 below.
- (5) When the Brazilian Minister of Agricultural Affairs visited Japan in October 1977, he had a talk, at the Brazilian Embassy-Tokyo, with Vice-president Hisamune, Director in charge of agriculture and forestry, and heads of the three agriculture/forestry divisions of

the Japan International Cooperation Agency (JICA). At that time the Brazilian Minister asked for Japanese cooperation on the issue which has developed into the Project. In November 1977 the Government of the Federative Republic of Brazil officially solicited the Government of Japan for technical cooperation.

2. Contents of solicitation

The State of São Paulo, the Federative Republic of Brazil, is a developed area in the country, where the greater part of forest has been changed into coffee plantations, grazing pastures, and others. As mentioned earlier, soil conservation and water source development problems are becoming more important in the state. JICA has been requested for technical cooperation on a project basis, based on the idea that the São Paulo Forestry Institute needs such Japanese cooperation for its research project.

The proposed fields of cooperation and the gists of their respective backgrounds are listed below.

(1) Watershed forest management

Cooperation in studies and research concerning forest management as a whole, centering on water and land conservation in order to minimize the adverse effect hereafter due to the large reduction of forest area as a result of the Paraiba watershed development.

(2) Mechanical logging

Technical cooperation in order to improve logging operations at artificial plantations on steep hills so that they may satisfy both watershed management and logging efficiency requirements.

(3) Small diameter timber processing

The Brazilian timber production is centered in the southern part of the country which is rich in arrowcarea (parana pine) resources and the Amazonian region in the north. They are both considerably apart from major places of consumption, which fact is giving rise to transportation cost problems. The development of artificial plantations of pine trees and eucalyptuses is in progress in the State of São Paulo. It will be epoch-making if timber obtained by thinning or grown-up trees there becomes available for logging.

The proposed cooperation involves logging techniques for timbers whose diameters are less than 40 cm (these techniques are not employed on a production basis in Brazil) and the preservation of products against decay. Afforestation efforts are expected to become all the more rewarding as technical capabilities in these fields are advanced.

(4) Remote sensing

Artificial plantations in the State of São Paulo grow so quickly that resources surveys have to be repeated all the more frequently over a short period. In this connection, remote sensing offers a useful survey tool, and the São Paulo Forestry Institute is fairly advanced in studies and research in remote sensing techniques.

On the other hand, the Amazonian forest resources are noted for the abundance of tree types. It is advisable to identify the more useful trees by photographic means in order to promote the development of the Amazonian district. The São Paulo institute asks for Japanese cooperation in the application of remote sensing techniques for this purpose.

(5) Plant breeding

As mentioned above, artificial plantations in the State of São Paulo is developed eagerly. However, they are devoted to pine trees and eucalyptuses which are of little value as saw-logs. Eucalyptuses especially tend to develop large cracks as they get dry, and are thus not suitable as saw-logs. The Brazilian proposal expects to tackle the issue from the plant breeding standpoint.

(6) Prevention of damage by blight and harmful insects

This item is also related closely to artificial plantations in the State of São Paulo. The proposed cooperation aims at establishing ways and means to prevent the damage which may be inflicted with time by blight and harmful insects on the plantations especially of eucalyptuses. This is a new challenge which the Brazilian authorities expect to meet, teaming up with Japanese experts.

(7) Protection and management of forest animals and plants

The population of the State of São Paulo is on the increase, especially tending to center on its larger cities. As a result, the proper

management of natural parks is becoming more important from year to year. The protection and management of animals and plants are regarded as a part of the park management program. The São Paulo Forestry Institute expects Japanese cooperation in general aspects of park management.

3. Survey objects

(1) The purposes of the surveys conducted by the JICA were to exchange views with the concerned staffs of the Ministry of Agricultural Affairs, Government of the Federative Republic of Brazil, and the São Paulo Forestry Institute, and to learn in detail their wishes as regards the proposed technical cooperation and confirm them. The purposes also include to investigate the status quo of the organization, facilities, equipments, research staffs, study items, etc. of the São Paulo Forestry Institute and their problematical aspects, and also to examine conceptual details of the forestry research project.

(2) The investigation and examination of the following items concerned to the seven proposed items of cooperation by the São Paulo Forestry Institute, which are listed in the "Contents of solicitation" in 2 above.

- i. Research items and schedules in detail.
- ii. Installation planning of necessary equipments.
- iii. Facilities required for tests and experiments.
- iv. Examination of possible fields of cooperation.

(3) The examination of necessary items for the initiation of cooperation on a project basis.

- i. Basic concept.
- ii. Place(s) and scale(s).
- iii. Equipment furnishing planning.
- iv. Cooperation procedures.

4. Survey team members and itineraries

(1) Team (preliminary survey) composition

Name	Task	Current Post
Hidenori Nakano	Team leader	Director, Forest Influences Div., Forestry & Forest Products Research Institute, Ministry of Agriculture, Forestry and Fisheries
Ken Uesugi	Cooperation planning	Assistant-chief, International Cooperation Division, Ministry of Agriculture, Forestry and Fisheries
Akio Sugii	Forestry research	Assistant-chief, Research and Extension Division, Forestry Agency, Ministry of Agriculture, Forestry and Fisheries
Junichi Shibata	Forestry machinery	1st Machinery Research Section, Forestry & Forest Products Research Institute, Ministry of Agriculture, Forestry and Fisheries
Susumu Suzuki	Wood processing	Head, Forestry Development Division, Japan International Cooperation Agency

(2) Team (preliminary survey) itinerary

Order of days	Date	Day of the week	Contents	
1	5 Apr. '78	Wed.	Leaves Tokyo for São Paulo via NY	
2	6 Apr.	Thur.	Arrives in São Paulo, and arranges schedules.	
3	7 Apr.	Fri.	Protocol visits to the Consulate General and the São Paulo Forestry Institute, and preliminaries about reference materials.	
4	8 Apr.	Sat.	Visit to the Itepetininga branch of the São Paulo Forestry Institute.	
5	9 Apr.	Sun.	Team meeting.	
6	10 Apr.	Mon.	Taubate sapling farm inspection, visit to Tenryu Mokko-Brazil, and overnight stay at Cunha.	Deputy team-leader Uesugi visits Ribeira.
7	11 Apr.	Tue.	Cunha experiment station inspection, and overnight stay at Campos de Jordão.	"

Order of days	Date	Day of the week	Contents
8	12 Apr.	Wed.	Campos de Jordão state park inspection, and returns to São Paulo. Deputy team-leader Uesugi returns to São Paulo.
9	13 Apr.	Thur.	Item-by-item studies at the São Paulo Forestry Institute, and protocol visit to the Secretary of Agricultural Affairs, State of São Paulo.
10	14 Apr.	Fri.	Continued item-by-item studies at the São Paulo Forestry Institute, and summing up and review of survey activities in general at the Institute.
11	15 Apr.	Sat.	Susano plantation inspection (mechanical logging)
12	16 Apr.	Sun.	Leaves São Paulo and arrives in Brazilia.
13	17 Apr.	Mon.	Preliminaries at the Embassy, and protocol visits to IBDF and CINGRA.
14	18 Apr.	Tue.	Protocol visit to SUBIN, and inspection of CEPAC.
15	19 Apr.	Wed.	Interim report, and visit to the Embassy.
16	20 Apr.	Thur.	Leaves Brazilia by air to Los Angeles via Rio de Janeiro, São Paulo and Lima.
17	21 Apr.	Fri.	Leaves Los Angeles for Tokyo via Honolulu.
18	22 Apr.	Sat.	Arrives at Tokyo.

(3) Team (implementation survey) composition

Name	Task	Current Post
Hidenori Nakano	Team leader	Director, Forest Influences Div., Forestry & Forest Product Research Institute, Ministry of Agriculture, Forestry and Fisheries
Satoshi Hashimoto	Cooperation planning	Overseas Technical Cooperation Officer, International Cooperation Division, Agricultural and Forestry Economy Bureau, Ministry of Agriculture, Forestry and Fisheries
Minoru Nakano	Forestry research	Director, Tohoku Branch station, Forestry & Forest Products Research Institute, Ministry of Agriculture, Forestry and Fisheries
Masayoshi Miyamae	General Affairs	Forestry Development Division, Japan International Cooperation Agency

(4) Team (implementation survey) itinerary

Order of days	Date	Day of the week	Contents
1	25 Nov. 1978	Sat.	Tokyo <u>JL005</u> New York, New York <u>PA211</u>
2	26 Nov.	Sun.	Arrives in São Paulo, and schedule arrangement.
3	27 Nov.	Mon.	Protocol visit to the Consulate General, explanation for basic ideas about the Record of Discussions (R/D).
4	28 Nov.	Tue.	Protocol visit to the São Paulo Forestry Institute, and discussions on the R/D draft.
5	29 Nov.	Wed.	São Paulo <u>VP290</u> Brasilia, and protocol visits to the Planning Agency and the Foreign Affairs Ministry and preliminaries.
6	30 Nov.	Thur.	Protocol visit to the Ministry of Agricultural Affairs and preliminaries. Brasilia <u>VP291</u> São Paulo.
7	1 Dec.	Fri.	Survey of projected sites of research cooperation by Team-leader Nakano and member Nakano (São Paulo <u>Car</u> Taubaté <u>Helicopter</u> Cunha), by Hashimoto and Miyamae (São Paulo <u>Helicopter</u> Cunha <u>Helicopter</u> — São Paulo). Negotiations with the São Paulo Forestry Institute about the signers.
8	2 Dec.	Sat.	Team-leader Nakano and member Nakano (Cunha <u>Car</u> São Paulo), and inspection of quarters for experts by Hashimoto and Miyamae.
9	3 Dec.	Sun.	Reference materials adjustment
10	4 Dec.	Mon.	R/D signing, and luncheon party under the auspices of the Agricultural Affairs Secretary, State of São Paulo.
11	5 Dec.	Tue.	Luncheon party sponsored by the Consul General. Leaves São Paulo by PA212, and stopover at Rio de Janeiro for aircraft trouble.
12	6 Dec.	Wed.	Rio de Janeiro <u>PA202</u>
13	7 Dec.	Thur.	Arrives at New York and leaves New York for Tokyo by <u>JL005</u> .
14	8 Dec.	Fri.	Arrives at Tokyo.

II. Summary of Survey Results:

1. In compliance with a request from the São Paulo Forestry Institute, the Federative Republic of Brazil, for technical cooperation for executing studies and researches in the following fields, JICA dispatched a team of experts to the country for on-site survey from April 5 through 22, 1978.
 - (1) Watershed management: Water and soil conservation.
 - (2) Mechanical logging.
 - (3) Small diameter timber processing.
 - (4) Resources remote sensing.
 - (5) Plant breeding.
 - (6) Prevention of damage by blight and harmful insects.
 - (7) Protection and management of forest animals and plants.
2. Among the seven fields listed above, Japan has been cooperation in (1) Watershed management and (2) Mechanical logging by dispatching their respective experts to the Federative Republic of Brazil on a short-term basis. In order to ensure the continued Japanese cooperation in these two fields and to expand Japanese cooperation into other fields, the São Paulo Forestry Institute solicited JICA for a more extensive version of cooperation on a project basis, based on the "BASIC AGREEMENT ON TECHNICAL COOPERATION BETWEEN THE GOVERNMENT OF JAPAN AND THE GOVERNMENT OF THE FEDERATIVE REPUBLIC OF BRAZIL".
3. In this survey, reference materials as to the natural and social environments, forestry situations and other related aspects of the State of São Paulo which form the background of the Brazilian request for forestry research cooperation in such broad fields were collected. The survey team also examined organization, financial and operation conditions, achievements, etc. of the São Paulo Forestry Institute. In addition, it conducted detailed investigations by hearings circumstances and exchanging views with the Brazilian authorities concerned about local situations and making on-site inspections on the seven proposed fields of cooperation in order to clarify the necessity and urgency of cooperation.
4. As a result of such fact-finding activities by the team, the significance or necessity of forestry research in the State of São Paulo is understood

as follows. Disorderly agricultural development has resulted in the steep reduction of forest area in the state from 65% of the total state land to less than 20% (including shrubberies called "serade") over the past 50 - 60 years, which causes worsening flood, soil erosion and dam/lake deposit problems. Thus the recovery of forest area is taking on extra urgency. In addition, progressive industrialization and marked concentration of population in cities over these years are adding to the immediacy of the question of adequate water sources. This also means the necessity of an increased forest area. Furthermore, the promotion of forestry is assuming to have a growing significance from the policy standpoint in order to realize the more effective use of land resources. This requires the establishment of advanced resources survey methods and rationalized timber production and processing techniques. It should also be noted that the recreational value of a forest to city inhabitants represents a new field of challenge to the forestry authorities. In order to cope with these problems, it is necessary to promote synthetic studies and researches, taking into account large functional potentials of forests.

5. The São Paulo Forestry Institute, the only research and experiment station in the State of São Paulo, has its forerunner established origin in 1896. It had been mainly engaged in the development of model artificial plantations for private enterprisers until 1970 when it was provided with a forestry research division. Its history as a research organization is very short. The number of researchers and facilities and equipments available at the institute are far from sufficient, except for the afforestation and plant breeding fields where it is credited with many years' experiences and tradition. The research levels at the institute may still be judged to be in the elementary or basic stage. In order to cope with the above problems successfully, it is of primary significance to upgrade the institute's research capabilities as quickly as possible. The institute itself makes much of enlarging its research staffs and its basic capabilities side by side with the improvement of research facilities and their equipments.

6. Research necessity or urgency as to the seven proposed fields of co-operations and possible Japanese contributions there can be summarized as follows:

(1) Watershed management: water and soil conservation

Judging from the current land conditions in the State of São Paulo, the reinforced research in this field is regarded as the most important. The Brazilian efforts in this field have just started with Japanese cooperation. In the circumstances, it is considered to be necessary to continue Japanese cooperation in plot and watershed tests for the selection of tree types fit for water and soil conservation and techniques whereby to judge the degree of contributions of afforestation to watershed management purposes (Japan has been cooperating in these issues on a short-term basis by dispatching experts in the respective fields as required). To escalate Japanese cooperation into the fields of devastated land afforestation and on-site compatibility tests is necessary.

(2) Mechanical logging

The establishment of low-cost logging techniques by mechanization is considered to be necessary, in keeping with the rapid development of afforestation. As for the recommended type of cooperation, it will be advisable for Japan to offer the cable logging technique on steep hillside to the lumber mill which is not yet available in Brazil.

(3) Small diameter timber processing

Although the development of applications of thinned woods (eucalyptuses and pine trees of American origin such as slash and tedar pines) is necessary and Japan is experimenting on various means to use such timber profitably, conclusive ways for the use have not been obtained yet. In the circumstances, it will be difficult to cooperate with the São Paulo Forestry Institute concretely on the issue. However, the introduction of sawing machines and sawmill tools of latest Japanese development, together with their technical instruction, will be highly useful in rationalizing the Brazilian sawing process.

(4) Resources remote sensing

The São Paulo Forestry Institute is fairly advanced in the application of aerial photography to land identification, having already been credited with impressive achievements. But the use of aerial photography for the assesment of forest resources and forestry conservation is still in an elementary stage. The research necessity of

the former field is justified, taking into account the huge land space of the country. It is also necessary to promote the use of aerial photography for forest conservation, judging from its potential contributions to watershed management. Since both of them still remain in the development stage in Japan, the Japan - Brazil cooperation in this field will inevitably be more of a joint research and development program when it is realized.

(5) Plant breeding

The São Paulo Forestry Institute is considerably experienced in plant breeding involving eucalyptuses and pine trees of American origin such as slash and tedar pines, and it has already attained a fairly high level of expertise. There is some room left for Japanese cooperation in the fields of seed and pollen preservation and seed-gathering techniques, however, its necessity or urgency is not considered so great.

(6) Prevention of damage by blight and harmful insects

No serious problem has so far developed in this field in the State of São Paulo. But with the increase of artificial plantations of single vegetation, there might be the possible outbreak of blights rather frequently in the future. The São Paulo Forestry Institute emphasizes basic studies and research for the future. It is considered possible for Japan to offer the guidance on research methods, etc.

(7) Protection of forest animals and plants

The São Paulo Forestry Institute initially asked for Japanese cooperation in the protection of forest animals and plants. It has been learned from the staff in charge, however, that it is more interested in information on the Japanese protection, management and application of forests, especially their institutional aspects. There is thus little necessity of cooperation in the research field.

7. Judging from the survey results described above, the recommended fields of cooperation in greater urgency and more promising in effectiveness can be summarized as follows:

(1) Term of cooperation --- 5 years

(2) Fields of cooperation

- a. Watershed management
- b. Mechanical logging
- c. Use of aerial photography for forest conservation
- d. Other necessary fields

(3) Dispatch of experts

(long-term)

- a. Team leader 1
- b. Watershed management 1
- c. Mechanical logging 2
- d. Liaison officer 1

(short-term)

- a. Aerial photography
- b. Timber processing
- c. Other necessary fields

(4) Necessary equipments, machinery and materials

- a. Machinery, equipments and apparatuses for laboratory work
- b. Machinery, equipments and apparatuses for experimental forests
- c. Vehicles for experiment stations
- d. Seeds, fertilizers, agricultural and other chemicals
- e. Audio-visual training aids and materials
- f. Books and other necessary printed matters
- g. Other equipments, machinery and/or apparatuses whose necessity is mutually agreed on

(5) Reception of Brazilian trainees

- a. Watershed management (short-term)
- b. Mechanical logging (short-term)
- c. Aerial photography (short-term)
- d. Forestry research in general (short-term, inspection)

III. Background of Fields Where Cooperation is Solicited by the São Paulo Forestry Institute

1. Watershed management

The State of São Paulo suffers from the yearly escalation in flood damages

and the constant contamination of its river/lake waters. Especially around the Paraíba basin, this problem is becoming more acute.

The causes for these phenomenon include the sandy, laterite composition of land which is essentially susceptible to erosion, the short but heavy downpour of rain everyday during the rainy season, land development which has extensively destroyed the vegetation in the riverhead mountain areas, and the progressive concentration of population and properties in low lands due to urban development and industrialization.

More than 80% of the area of the State of São Paulo was used to be covered with forests more or less. However, intrusions by Europeans into the country gradually destroyed the forest land by developing the sugar cane, rubber, cotton and coffee plantations. As a result, today, the forest land including artificial plantations and shrubberies (campos serade) accounts for only 20% of the total land. Coffee plantations were developed quickly one after another throughout the mountains Ceramadore, Ceraque Blancangaria and Cerada Mantiquera districts along the Paraíba, starting from about 1850. The slash-and-burn method of coffee cultivation, however, had exhausted the land completely by about 1930 that coffee cultivation had to move to other places, leaving a vast waste land behind. The waste land gradually became a grassland, which was then used for the grazing of cattle. Grazing, however, was left to chance, and little attention has been paid to grassland management. The consequent decline of grass vegetation and the enlargement of cattle paths have developed red, naked surfaces almost everywhere in the district. This leads to the uncontrolled runoff of river water and sandy soil, thus making the major cause of the flood and river/lake contamination problems encountered today. Especially the naked land is frequently observed in indented places or on banks due to the grazing habit of cattle and the concentrated flow of surface water, which in turn accelerates the destruction and/or erosion of banks. Brazil is a land of motor traffic with an extensive cross-country net of various types of roads. Many of these roads, however, are not protected at all on the surface or sides against erosion. This makes another major cause of the flood and river/lake contamination problems.

On the other hand, the watershed of the Paraíba lies between the two major cities of Brazil, São Paulo and Rio de Janeiro. The low land in

this area attracts industrialization and social development activities from these two cities, accounting for 37% of the yearly gross national product of the Federative Republic of Brazil. The population there doubles every 10 years. In the circumstance, the securing of adequate supply of service and industrial water side by side with the prevention of floods is posing a major problem these days.

The State Government of São Paulo is trying to reduce flood potentials and secure enlarged water sources by building a number of dams. The prevention of dam/lake buried problems and the removal of red contaminants from the river water pose a major concern. In this connection, the review of land application in the watershed and the afforestation especially of the naked land are regarded as matters of extra urgency. Afforestation with the careful selection of a proper type of trees and in strategic places is a relatively inexpensive and easy-to-execute means for the prevention of flood and soil erosion over a wide area. It is also regarded as the most realistic and important approach, offering useful potentials in fields other than disaster prevention at the same time.

In the circumstances, the Forest Act has been established, testifying to the official support of the public utility functions of forest. The strict conservation of existing forests and the encouragement of forestation on top of compulsory forestation requirements are recognized in policy terms. There also is an idea which expects to allocate parts of the petroleum consumption tax revenues to government-sponsored forestation in a private land.

However, little knowledge of the desirable type of forest, its location and afforestation knowhow from the watershed management standpoint is available locally. The necessity of accelerated tests and researches in order to fill in the gap is strongly recognized. No research has been conducted in these fields in the country; the São Paulo Forestry Institute does not have any laboratory specializing in these issues in its research division. Even in forestry department of universities, lectures based on knowledge acquired by foreigners are given by instructors who have studied these subjects abroad recently. So the Sao Paulo Forestry Institute is determined to initiate studies and researches on them and establish the necessary setup within its organization as quickly as possible.

2. Mechanical logging

In the mechanical logging field the Forestry Institute of the State of São Paulo is firstly solicited Japanese cooperation in introducing the technique of cable logging. The idea is to test the compatibility of this technique at eucalyptus plantations (complete deforestation) and pine plantations (thinning) on steep hillsides whether it contributes to the prevention of soil erosion and forest land conservation or not.

Also the solution of pending problems such as the improvement of cutting efficiency, promotion of thinning operations, etc. may be confirmed.

After the technique reaches the trail research and technical familiarization stages, the São Paulo Forestry Institute expects to spread the use of cable logging technique among private enterprises. What has motivated the São Paulo Forestry Institute for the introduction of the cable logging method in the country can be summarized as follows:

A typical eucalyptus plantation is cut in 5 - 10 years, usually 7 years, after trees are planted. Regeneration by sprout and deforestation are repeated twice afterward. A eucalyptus at the time of deforestation grows 15 - 20 m in height and 15 - 25 cm in diameter breast high.

A typical plantation consists of 1,600 - 2,000 of them per hectare with the accumulation of 200 - 350 m³ per hectare. On a flat land, when trees are clear cut transport trucks are driven into the plantation, onto which fallen trees removed of branches and barks and cut into proper length are loaded. Work carried out today is simple and has no special problem. On the other hand, when a plantation is on a slope, fallen trees removed of branches and barks are carried to the side of a woodland path, by man or by means of a mantractor combination where they are loaded on trucks. Such operation sometimes damages the woodland. It also needs a considerably large manpower in addition to the construction of the tractor path. It is desirable to improve it in these aspects.

A typical artificial pine plantation expects 2,000 - 4,000 trees planted per hectare, clear cutting at 25-year intervals, and 250 - 300 trees finally available for cutting. Thinning should be carried out twice in the meantime according to current practices. It has been about 20 years since pine tree cultivation started on a regular basis; the area which requires thinning is considerably large now. However, a proper method of collecting timber from thinning especially at a plantation on a slope is not known, and, as a result, there are few examples that

thinning is performed on a regular business basis. At some plantations on a flat land, a line of trees are cut down for every 10 lines to provide passages for trucks, and fallen trees are collected using manpower or horses.

In the circumstances much is expected of the cable logging technique to collect fallen trees from plantations on a slope or in a mountainous area. The reasons for this listed by the São Paulo Forestry Institute include: 1) smaller damage potentials to the woodland, compared with the construction of truck or tractor paths; 2) contributions to reduced labor, improved safety and more stable turnover, coping with the reduction of available labor and hikes in labor costs; and 3) the expected shift of forestation efforts into the mountainous district as the flat land is developed more progressively for other purposes (artificial plantations on steep hillsides account for approximately 10% of the total now.

In addition to the above-mentioned cable logging technique, the proposed mechanization of forestry includes: a) disposal of roots of eucalyptuses which are cut down; b) improvement of planting machines available for the flat land; c) lopping; and d) improvement of chain saw operations.

Roots of eucalyptuses remaining in the ground may spring up unnecessary sprouts. Depending on their height above ground remaining roots may also stand in the way of subsequent work, for instance, vehicle traffic may be interrupted within the plantation. In order to remove them, it is necessary to cut them out, pull them out or chip them away. Such work requires a large amount of labor, and will become increasingly problematical as the number of old plantations rises hereafter. A unique pot seedling planting machine is employed at the São Paulo Forestry Institute, capable of planting 1,300 seedlings a day per machine. There does not seem to be anything especially unsatisfactory with the machine. However, the fact that a tractor and a team of 13 workers are required to operate it suggests some room for improvement from the efficiency standpoint. Concerning to lopping, there is no universal method employed; the institute is now in the process of looking for more efficient methods and apparatuses. Chain saw available are almost exclusively supplied by one manufacturer, and the institute is interested in more efficient types of chain saws, regarding it also as necessary to train chain saw operators in a more rewarding way.

3. Small diameter timber processing

Brazil with its huge land area is understood to be endowed with superior large-diameter timber resources large enough to meet the domestic demand. The shift of the center of the production of such timber to the northern Amazonian district, distant from the industrialized districts in the south, means an escalation in transportation costs, which is already exerting influences on the demand-and-supply situation in the south.

On the other hand, artificial plantations in the State of São Paulo are ready to be cut, and the use of logs that will be produced from them is considered seriously. These logs are presently used for the production of wood pulp for paper manufacturers and charcoal for the iron and steel industry. Their producers, however, hope for more useful applications of their products, for instance, in the form of processed timber.

Compared with their natural counterparts, however, logs from artificial plantations in the State of São Paulo are handicapped with quality problems, which may be attributable at least in part to the fact that they grow rather quickly (eucalyptuses are cut down in 7 - 8 years on average after they are planted, and Elliott pines in several decades). Especially Eucalyptuses, which grow so quickly, develop large cracks on the cut end immediately after they are cut down.

The São Paulo Forestry Institute is interested in studying the possible improvement of the product quality of eucalyptuses from the plant breeding standpoint.

As regards pine trees, the institute has been considering to use them as processed timber. However, it is scarcely experienced in the field of small-diameter needle-leaf wood processing at the institute. On the other hand, Japan is credited with long experiences and advanced skills in the processing and application of small-diameter, needle-leaf trees produced in artificial plantations. The São Paulo Forestry Institute is interested in introducing the Japanese know-how in these fields so that pine trees from artificial plantations may be used as building and box manufacturing materials.

Forest amounts to less than 10% of the total area of the State of São Paulo. Trying to improve the effectiveness of its watershed management efforts by afforesting as much as possible, the State Government bases

its forestry policy on the greater promotion of artificial afforestation. In order to attain this purpose, it is considered most advisable to increase the value of products of artificial plantations.

4. Resources remote sensing

(i) Status quo of the São Paulo Forestry Institute

The status quo of the São Paulo Forestry Institute, which has been learned by on-site inspection, can be summarized as follows:

- 1) Aerial photographs of the entire State of São Paulo were taken in 1971 - 1973, and the following activities were conducted using them:
 - a) Land application conditions all over the State of São Paulo; and
 - b) Pine and eucalyptus afforestation conditions all over the State of São Paulo.

The photographed area was divided into a grid of 1 km-square sections, and land application or pine/eucalyptus afforestation conditions were identified on a section-by-section basis using aerial photographs. The final purpose was to confirm their respective shares in the total land area of the State of São Paulo.

Furthermore, the institute is now engaged in the "Land survey for the production of an afforested land location map in the State of São Paulo". The afforested land locations are mapped through the simple graphic rendition of aerial photographs. The map together with the data obtained from IBDF's review of afforestation work completed* will provide the preparation of a list of afforested lands within the State of São Paulo.

* In the Federative Republic of Brazil the necessary expense of artificial forestation by a private enterprise is credited against the income tax imposed on it, and is refunded by the Government. (The upper limit of refunding is 20% of the amount of income tax in question.) IBDF is the governmental institution responsible for confirming that afforestation work has actually been accomplished.

2) Current technical levels

a) Photograph analysis

As seen in its past achievements, the institute is judged to have an adequate level, at least in the basic techniques, of the application of photography and the qualitative analysis of photographs.

There seems to be some room left for improvement, however, in the field of quantitative analysis of photographs especially with regard to the followings:

- i. Measurement of the height of a place above the sea level or the height of a tree;
- ii. Measurement of the gradient of a slope;
- iii. Use of various types of templates for plot extraction, etc; and
- iv. Preparation and application of aerial photograph-based accumulation tables.

As regards iv, however, it should be noted that the institute is reported engaged in the development of a technique which will enable researchers to confirm accumulation conditions at the *Pinus elliottii* artificial plantation through the automatic analysis of aerial photographs.

b) Graphic rendition of photographs

The technique of producing graphic versions of photographs using a simple conversion machine seems already available at the institute.

3) Current staff

Currently, the staffs in charge are Sr. Ogawa and Sr. Aoki, but it is likely to be enlarged in the near future. Sr. Aoki is studying Landsat applications at the University of Piracicaba.

4) Current equipments and materials

The following equipments and materials are currently available at the institute.

- (a) Stereoscope Reflection type One
- (b) Stereoscopes Portable Several units
- (c) Parallax bar One
- (d) Simplified photograph converter One
 (Bausch & Lomb Zoom Transfer Scope)
- (e) Aerial photographs Scale: 1/25,000 approx.
- (f) Aerial photographs Scale: 1/45,000 approx.
- (g) Base maps Scale: 1/50,000
- (h) Calculator (Olivetti Programer 101)

(2) Direction of future research at the institute and request for Japanese cooperation

The following items are listed as major research fields hereafter by the institute, which seeks research cooperation and technical guidance by Japanese experts.

1) Forest accumulation identification technique

- (a) Accumulation identification using data collected by Landsat satellite.
- (b) Accumulation identification through the quantitative analysis of aerial photographs.

As regards (b) the institute is especially interested in the accumulation identification technique concerning artificial or natural forests of eucalyptuses.

2) Application of aerial photography for forest conservation

- (a) Aerial photography based forest conservation survey techniques in general.
- (b) Aerial photography-based forest conservation work implementation and design techniques.

3) Techniques of producing high-precision graphic versions of aerial photographs

The institute wants a high-precision photograph convertor capable of producing base maps on a scale larger than that of current base maps (1/50,000) together with its handling know-how.

4) Multi-spectrum band measurement technique

5. Plant breeding technique

(1) Status quo of the São Paulo Forestry Institute

The status quo of the São Paulo Forestry Institute, which has been learned as a result of on-site inspection, can be summarized as follows:

1) Past research achievements

- (a) Eucalyptus seed trees selection and seed collecting plantation development.
- (b) Eucalyptus genealogy tests.
- (c) Pinus genealogy tests.
- (d) Inducement of mutation in eucalyptus and its biological effect.
- (e) Pinus seed collecting plantation development.
- (f) Influence of forest density on pinus caribaea seed production in qualitative and quantitative terms.

2) Current technical levels

(a) Selective plant breeding technique

The institute has the technique of selecting more rewarding types of plants (with emphasis on quality rather than growth potentials) and collecting seeds from them for the purpose of selective plant breeding. (Emphasis has been shifted from group selection to individual selection.)

The generation test and verification are also conducted.

(b) Crossing plant breeding

The research in crossing plant breeding has just started and significant achievements have not been yet.

(c) Creative plant breeding

The application of colchicine for eucalyptus breeding has been tested, but desired results have failed to be obtained. It seems that the failure was not a technical one.

The institute is equipped with neither technical capabilities nor facilities for evaluating the effect of isotopes

on plant breeding. The University of Piracicaba is known to have conducted some experiments on the application of isotopes to plant breeding, but positive results were not obtained.

3) Current staff

Four researchers under Sr. Cessario and three skilled workers. In addition, five inspectors with the expert knowledge of plant breeding are assigned to local test stations.

4) Current equipments

The following equipments are available.

o Research division

- (a) Germination test/verification chambers
- (b) Germination test/verification chamber (program type)
- (c) Microscopes
- (d) Chromatograph
- (e) Specific gravity measuring apparatus
- (f) Mixer
- (g) Centrifugal separator
- (h) Scorching furnace
- (i) Seed screen (wind type)
Seed eliminator (agitator type)
- (j) Seed vender
- (k) Seed packing machine
- (l) Balances
- (m) Mass spectrometers
- (n) Self-registering thermometer
- (o) Self-registering hygrometer
- (p) Distilled water supplier
- (q) Refrigerator

o Business division

- (a) Seed screen (for pine seeds)
Seed eliminator (for eucalyptus seeds)
- (b) Seed stock chamber (low temperature dry, 10 tons)
Seed stock chamber (dry)
- (c) Temporary warehouse of seeds obtained in the market

(d) Germination test/verification chambers

(e) Seed cleaner

- (2) Direction of future research at the institute and request for Japanese cooperation

The following items are listed as major research fields hereafter of the institute, which seeks research cooperation and technical guidance by Japanese experts in addition to the introduction of Japanese know-how and equipments.

- 1) Research in the treatment and preservation of pollen for crossing plant breeding.
- 2) Research on the method of preservation of seeds of selected trees for afforestation.
- 3) Basic studies and research on physiology and ecology of trees.
- 4) Research on cuttage and grafting.
- 5) Research on seed collecting techniques.

6. Prevention of damage by blight and harmful insects

- (1) Status quo of the São Paulo Forestry Institute

The status quo of the São Paulo Institute, which was learned by the on-site inspection, can be summarized as follows:

- 1) Past research achievements
 - (a) Susceptibility of pine trees of North American origin to damages by blight and harmful insects
 - (b) Reaction of *Toona ciliata* var. *australis* to *H. grandella* damage
 - (c) Studies of the life in needle-leaved forest in the State of São Paulo
 - (d) Research on the prevention/extermination of *Cidia araucariae* in *Araucaria angustifolia* timber
 - (e) Prevention/extermination of damage by blight and harmful insects to forestry in the State of São Paulo

2) Current technical levels

(a) Blight

The institute already has the technique of isolating, cultivating, identifying and classifying germs.

(b) Mycorrhiza

The institute is in the process of acquiring basic research skills.

(c) Damage by harmful insects

The institute is capable of classifying harmful insects.

3) Current staff

Sra. Eliza is in charge of blight research, Sr. Nilse mycorrhiza studies, and Sr. Wallace and Sr. Edison research in damage by harmful insects. They have five other skilled workers working for them.

4) Current equipments and materials

The following equipments and materials are available.

o Blight

(a) Microscopes

(b) Microtomes

(c) Thermostatic chamber

(d) Dehumidification/sterilization chambers

(e) Humidified sterilization chamber

(f) Shaker

(g) Balance

(h) Blight samples

o Damage by harmful insects

(a) Microscope

(b) Dehumidification/sterilization chamber

(c) Balance

(d) Insect samples

- (2) Direction of future research at the institute and request for Japanese cooperation

The following problems are encountered within the State of São Paulo, and the institute expects technical guidance by Japanese experts in order to prevent or exterminate them.

- 1) Cancro diaporthe cvbensis in eucalyptus

This blight tends to break out more frequently in the northern states of the country, and is reportedly observed in seven to eight places within the State of São Paulo today. It causes peeling off of barks and retardation of the growth, although trees do not wither usually.

The current extent of damage in the State of São Paulo is not so great, but the institute is wishing to prepare for the future.

- 2) Cylindrocladium Spp

This is known to attack various types of trees especially of artificial plantations, and causes them to die at the end.

- 3) Physiological problems due to the lack of calcium and magnesium in the soil.

- 4) Various types of blights attacking seedling farms.

- 5) Insect damage (Ipsimira grandela) to cedros (Iebanese cedar).

- 6) Ant (kenken) attack on leaves.

7. Protection and management of forest animals and plants

- (1) Status quo of the São Paulo Forestry Institute

In order to realize a good harmony between the protection of the forest land which is diminishing in the State of São Paulo (approximately 8% of the total land area today) and the development of recreational value of such land, the São Paulo Forestry Institute has been making efforts since 1972 to make out forest districts as state parks and preserve and manage them more profitably. Its achievements can be summarized as follows:

- Establishment of the Campos de Jordão state park management program and its implementation.

(2) Request for Japanese cooperation

The institute expects the following from the Japanese side in the proposed cooperation.

- (a) Providing information on the status quo of the Japanese administrative efforts for the protection of natural environment.
- (b) Training of the concerned technical staff by Japanese experts.
- (c) Interflow of on-site inspection activities.

IV. Direction of Forestry Research Cooperation

1. Watershed management

Against the background described above, for the purposes of more profitable water and soil conservation in the mountainous and hilly districts along the Paraíba, the State Government of São Paulo strongly expects Japanese cooperation in studies and evaluation of methods that would enable to use functions of the forest land. Their proposed contents can be listed as follows:

Firstly comes the research in the water/soil conservation functions of the forest land and methods of selecting desirable type of forest.

This boils down to a series of experiments in order to grasp the water/soil conservation functions of the forest land in qualitative and quantitative terms and, at the same time, select proper types of trees and methods of their planting to reforest the devastated land. Concretely, functional contributions will be compared between various types of broadleaf trees native to the district and eucalyptuses/pine trees of North American origin which are known to grow in the devastated land.

The methods are as follows: first, diverted waterbalance, surface runoff volume, and amount of land erosion are examined relatively briefly by plot tests over short period, and more desirable types of trees and afforestation method are selected preliminarily. Then, at the watershed test station, the water/soil runoff preventive effect of the selected type of forest against devastated grassland is examined. Such approach is regarded as advisable, and plot test and watershed experiment techniques already available at Forestry & Forest Products Research Institute

and some universities in Japan are directly compatible with it. In the circumstances, it is possible for Japan to cooperate with the Brazilian authorities in this field.

Second is the research on the method of selecting places for strategic afforestation for water/soil conservation.

It is impossible to reforest the entire devastated land along the Paraíba. Strategic places must be selected, where reforestation effects are expected to be the biggest, and selected type of trees must be planted there. The São Paulo institute seeks Japanese cooperation in the development of a proper method of determining the valuable sites for afforestation. The devastated land and water/soil conservation potentials judgement methods, having already been put to practical use in Japan, are considered applicable to the initial stage of the proposed research. The judgement method that will satisfy local requirements may be established based on the results of preliminary tests using the Japanese methods. Full-scale development efforts may be initiated in line with the objectives thus established.

Third is the research on a simplified forestry conservation engineering method that will complement the water/soil conservation functions of forests.

It is possible to plant seedlings or seeds directly in the field, if land is in the early stage of devastation. Seedling/seed planting is impossible, however, on the land where rill erosion and gully erosion proceeds to a considerable extent, because surface soil moves considerably. It is thus necessary to install supplementary structures in one way or another in order to stabilize the surface conditions for seedlings to root.

The São Paulo institute seeks Japanese cooperation in tests and researches for the development or selection of structure type(s) which would satisfy local conditions and requirements. Since the greater part of devastated land in the district in question is free of large pebbles or broken pieces of rocks, fairly simple types of grading work, sheathing, fencing, reinforcement, stepping, channel work, dam, retaining wall and other forestry conservation/flood control engineering techniques available in Japan are considered applicable. It will thus be possible to test their on-site applicabilities using materials locally available for the initial transfer of technical know-how, and decide the types of techniques that

will satisfy local requirements so that development efforts may be centered on them.

Fourth is the integrated evaluation of watershed management.

A scaled-down version of a reforestation program designed for a test watershed more than hundreds of hectares in area including the devastated grassland will be implemented in a strategic place with simple flood control structures, and quantitative, qualitative and time characteristics of water/soil runoffs before and after afforestation will be compared so that contributions of afforestation to watershed management may be proved and confirmed in both qualitative and quantitative terms, followed by the establishment of a guideline for the execution of a full-scale afforestation program. The São Paulo institute seeks Japanese cooperation in such evaluation operations. The necessity of the proposed evaluation of the effect of afforestation is well recognized, and it is possible for Japan to cooperate with the Brazilian authorities concerned. The suggestion is that Japan should unite efforts with them on a project basis in the initial design and implementation phases of the evaluation program (which will naturally consume time) so that Japanese contributions in subsequent phases may be provided on a short-term basis when necessity arises.

2. Mechanical logging

The São Paulo Forestry Institute is especially interested in the ropeway method of collecting fallen trees, and with good reason. The ropeway technique available in Japan today can satisfy the majority of the Brazilian requirements. In the circumstances, it will be advisable to build a proper ropeway system on the spot and demonstrate collecting operations with it in the initial phase of research cooperation. In this case, some details of the selected system --- capacities of stubs that will be used as anchors, stay requirements and selection, necessity of artificial structures, etc. --- will have to be examined on the spot. On-site demonstration will enable the Brazilian staff to learn technical aspects of the ropeway system operation and confirm its capabilities and potentials in the local environment. The following comparison with other collection methods and applicability examinations will lead to answers to the questions: What should be done to promote research on, and applications of, the ropeway system, and how? When these preliminaries are duly accomplished, the ropeway system is expected to play a really useful

part as a means to collect fallen trees from plantations.

As regards the problems (a) through (d) which were mentioned earlier in this report, they are considered to be less significant, compared with the introduction of the ropeway system. For the present they can be adequately dealt with by exchanging information and opinions with the Brazilian authorities concerned. As for the improvement of chain saw operations, for instance, a training system which is established and in service in Japan is regarded as immediately compatible with the Brazilian requirements.

3. Small diameter timber processing

Application of small-diameter timber especially from the thinning of artificial plantations is being actively explored in Japan. Needless to say, it is extremely difficult for such timber to come out the winner in the market, competing with large-diameter timber imports coming in on a large scale.

In order to encourage the application of small-diameter timber, Japanese efforts center on the reduced logging costs, improved processing techniques and development of new demand. Perseverance is the word for the promotion of these efforts, while moves in the market price have great influence on the consumption of small-diameter timber.

Will the proposed cooperation with the São Paulo Forestry Institute produce a means that will positively enhance the applicability of small-diameter timber? The prospect is negative, generally speaking. Judging from what has been experienced in Japan, it will not be easy to develop an epochal method of small-diameter timber application.

As mentioned earlier in this report, the application of small-diameter timber is not known in the State of São Paulo; it will be difficult, if not impossible, for sawmill operators having been accustomed to the processing of large-diameter timber to work on small, needle-leaf materials from artificial plantations successfully. The commonest artificial plantation timber processing technique available in Japan is entirely new to Brazilian sawmill operators, as things stand today.

It will be advisable for Japan to start cooperation with the São Paulo Forestry Institute by demonstrating basic small-diameter timber processing techniques in the first place and then proceeding with the introduction

of their more advanced versions after the Brazilian staff has learned basic know-how. This is also what is expected by the São Paulo Forestry Institute. Such cooperation is regarded as conducive to the reinforced watershed management, based on which the State Government of São Paulo is going to promote its forestry policies.

4. Resources remote sensing

This represents the field of technology which matches the wish of the Federative Republic of Brazil, i.e. the quickest possible identification of latest conditions of its huge forest resources as inexpensively as possible. The Brazilian request is thus regarded as all the more urgent. This field of activities also happen to represent the specialty of President Kronka, the São Paulo Forestry Institute. Account may have to be taken of this fact in finalizing the Japanese response to the issue.

Fortunately, for Japan, resources remote sensing is regarded as a field in which relatively few problems will be encountered in dealing with the Brazilian wish. It is desirable that the Brazilian request should be considered in as encouraging terms as possible. It is suggested that the contents and other details of Japanese cooperation should be oriented as follows:

A. Contents of research cooperation

(A) Forest accumulation identification technique

a. Application of data collected by Landsat satellite

The Japanese research on Landsat-derived data applications is limited to the qualitative analysis of information (for instance, to identify forest growth potentials or the status quo of land applications). The quantitative analysis of the satellite data is being pursued, but it will take some time before effective results are obtained.

In the circumstances, or the present, it will be advisable to promote cooperation with the Brazilian authorities concerned, centering on the exchange of research information with them.

b. Application of data collected by ordinary aerial photographic means

The cooperation objective may be attained rather easily by

instructing the Brazilian staff in aerial photograph-based data listing and application techniques which are already commonly used in Japan.

However, the artificial/natural eucalyptus forest accumulation identification as proposed by the São Paulo institute is likely to lose accuracy more or less. Joint research by Japanese and Brazilian experts will be required to deal with the accuracy problem in eucalyptus forest accumulation data.

(B) Aerial photography application to forestry conservation

a. Forestry conservation total survey

The Brazilian wish to grasp the status quo of forestry conservation by means of aerial photography may be met with the technique already attained a good practical stage in Japan.

Japan is also scoring acceptable results at least in forecasting degradation. It will be advisable to offer the Japanese technique and deal jointly with the Brazilian authorities concerned those problems which may arise in its application in local environment.

b. Forestry conservation work implementation design technique

The cooperation objective may be attained by instructing the Brazilian staff in the technique already put to practical use in Japan. Details planning, however, expects the use of very large-scale maps, and attention will have to be paid to this respect.

(C) High-precision graphic rendition technique

The São Paulo institute seems to expect to solve problems raised by the current small-scale (1/50,000) base maps.

The Planning Bureau of the State Government of São Paulo is reported at work on a program to produce topographical charts on a scale of 1 to 10,000. It will be necessary to consider the acceptability of the Brazilian request, taking also into account how this program develops.

(D) Multi-spectrum band measuring technique

The history of Japanese research in this field is short, and active research efforts are being made in its many aspects. It is possible, however, to provide technical guidance of parts where positive research results have already obtained. It will be advisable to promote the exchange of research information with the Brazilian authorities concerned side by side with technical guidance.

B. Research cooperation setup

Few, if any, differences exist in environmental conditions, which may stand in the way of the Brazilian introduction of Japanese techniques concerning this theme. The kind of techniques having already been put to practical use in Japan will be learned by the Brazilian staffs concerned relatively easily.

On the other hand, the fact is that the number of researchers specializing in the fields listed above is limited in Japan. It will be difficult for them to stay in Brazil over a long period for on-site instruction. In the circumstances, the desirable cooperation setup can be summarized as follows:

- (a) Training of Brazilian experts in Japan.
- (b) Furnishing of equipments that will be instrumental to the implementation of techniques provided by the Japanese side.
 - i. Aerial photograph converting machines
 - ii. Various types of templates
- (c) Furnishing of texts which will be used in technical training in Brazil by Japanese side.
- (d) Dispatch of Japanese experts to Brazil on a short-term basis.
- (e) Exchange of research information between Japan and Brazil.

5. Plant breeding technique

The Brazilian authorities concerned are known to be making a thorough examination of an extensive literature of foreign origin concerning this theme, and are understood to have attained a fairly acceptable technical level as far as research is concerned. The indication is that they expect

Japanese instruction in concrete know-how.

The proposed cooperation may possibly compete with the technical cooperation project which is going to be implemented in the Amazonian district. This must be taken into account in considering its acceptability.

6. Prevention of damage by blight and harmful insects

The damage done to forestry by blight and harmful insects does not seem to be of any critical proportions in the State of São Paulo today. The São Paulo Forestry Institute seems to be interested in augmenting its basic research capabilities through Japanese cooperation as part of its efforts to prepare for possible future problems.

While exchanging information at on-site inspection, the impression was that the situation was more threatening in the northern, tropical part of the country outside the State of São Paulo. It will be necessary to consider the acceptability of the Brazilian request concerning this theme, taking into account its probable bearing on the technical cooperation project in progress in the Amazonian district.

7. Protection and management of forest animals and plants

The São Paulo institute having been receiving guidance by various foreign experts (American, West German, etc.) on this theme does not seem to be inclined to total dependent on Japanese techniques. The strong impression is that the Brazilian authorities concerned intend to learn as much as possible about foreign systems and their application status so that they may work out a protection/management system of their own by adopting and rejecting them.

In the circumstances, it will be advisable for Japan to center its cooperation on the supply of information about Japanese systems of forest life protection and management and their actual state of applications in addition to research information.

V. Research Cooperation Program

1. Basic concept

The Forestry Div., Agricultural Affairs Bureau, State of São Paulo, has been engaged in the development of model artificial plantations by

saplings of pine trees of North American origin and planting them in the land it has purchased from private owners, and the enforcement of strict administrative measures for the protection of natural forests which remain on such a diminished scale within the state. In this way it has been as successful as desired in making the people of the State of São Paulo recognize the significance and possibility of reforestation.

The Research Division was newly established in 1970, designed to be instrumental to the major objectives of reforestation, i.e. increased production of timber and more versatile application of it, and the rational development of utility functions of the reforested land. The enlarged organization was renamed the São Paulo Forestry Institute.

Forestry research is the main task of the São Paulo institute. Yet forestry as a science is relatively new to the Federative Republic of Brazil, where forestry courses began to be available at university level only seven to eight years ago. In the circumstances, the São Paulo Forestry Institute has managed to map out the direction in which its research activities will be promoted hereafter, having little time as yet to equip itself with necessary equipments and facilities and train the research staff. Actually many of its research activities remain to be initiated, while what few programs it has managed to get started are still in the very elementary stage.

It is against this background that it has solicited Japan for cooperation. As a result, research cooperation should actually aim at contributing to the establishment of research methods in the initial phase of the institute's activities and the fulfillment of equipment/facility requirements at the institute rather than advanced joint research operations between the institute staff and Japanese experts dispatched there.

At least for the first phase of the proposed cooperation project Japanese contributions in the manner described above are regarded as necessary and useful.

The furnishing of equipments and materials and the training of Brazilian trainees in Japan will thus be assumed as primary significance. As regards the dispatch of Japanese experts, it will be necessary and useful to send experts who are well versed in the each field of proposed cooperation, taking into account the institute's readiness to receive

them. It will also be advisable to dispatch them largely on a short-term basis. The Japanese experts should include technicians and skilful workers as well as researchers.

2. Research cooperation fields and tasks

Field	Task	Cooperation outline
I Watershed management technical research	<ol style="list-style-type: none"> 1) Forest hydrological test method 2) Devastation/flood potentials judgement method 3) Simple conservation structures application method 	<p>Confirmation of the water/soil conservation effect of reforesting the devastated land transfer of the plot, watershed and other hydrological test methods for the selection of proper types of trees and their planting methods.</p> <p>Establishment of the method of deciding reforestation sites for water/soil conservation purposes and transfer of the devastated land survey method to grasp topographical conditions and the hydrological survey method using the multi-channel watershed technique.</p> <p>Transfer of technical skills in devising, selecting, designing and implementing simple structures required for reforestation of the devastated land and water/soil conservation purposes and their improvement.</p>
II Logging technical research	<ol style="list-style-type: none"> 1) Application of a simplified ropeway system for collecting fallen trees 2) Application of a large-scale ropeway system for collecting fallen trees 3) Application of monorail and tractor methods of collecting fallen trees and improvement of other mechanical means 	<p>Transfer of basic technical skills in the design, installation, operation and other aspects of a simplified ropeway system for the collection of small-diameter trees cut down in the mountainous district for soier/soil conservation purposes, and its improvement.</p> <p>Transfer of technical skills in the design, installation, operation and other aspects of a large-scale ropeway system for the collection of small-diameter trees cut down in the mountainous district for conservation purposes, and its improvement.</p> <p>Transfer of technical skills in the design, installation, operation and other aspects of the monorail method in flat land and basic techniques of the tractor method for the collection of small-diameter trees cut down, and improvement of these and other mechanical means.</p>

Field	Task	Cooperation outline
<p>III Remote sensing technical research</p>	<p>1) Forest accumulation analysis method</p> <p>2) Watershed condition analysis method</p>	<p>Analysis of actual accumulation and other conditions of artificial plantations of eucalyptuses and pine trees, based on aerial photography- and Landsat satellite-derived data, and method of research in it.</p> <p>Analysis of topographical features, conditions of devastation, etc. of the watershed, based on aerial photography- and Landsat-derived data, and method of research in it.</p>
<p>IV Small diameter timber processing technique</p>	<p>1) Small-diameter timber sawing and processing improvement</p>	<p>Transfer of sawing techniques for the improvement of efficiency and yield of sawing operations of small slash pine logs, and their technical improvement.</p>

3. Research cooperation schedule

Field	1st year	2nd year	3rd year	4th year	5th year
Cooperation summary	<ul style="list-style-type: none"> o Expert dispatch (one on a long-term basis) 	<ul style="list-style-type: none"> o Expert dispatch (one on a long-term basis) 	<ul style="list-style-type: none"> o Expert dispatch (one on a long-term basis) 	<ul style="list-style-type: none"> o Expert dispatch (one on a long-term basis) 	<ul style="list-style-type: none"> o Expert dispatch (one on a long-term basis)
I. Watershed management technical research	<ul style="list-style-type: none"> o Expert dispatch (one on a long-term basis, two on a short-term basis) A, B test watershed areas setting, Weir and water gauge installation, Watershed rain gauge installation, Watershed exposed meteorological apparatus installation, Plot test A zone, Water gauge and exposed meteorological apparatus installation, Watershed basic conditions research method, Water level and meteorological observation methods and data arrangement method o Reception of Brazilian trainee (one on a short-term basis) o Furnishing of equipments and materials (as listed separately) 	<ul style="list-style-type: none"> o Expert dispatch (one on a long-term basis, two on a short-term basis) C, D, E test watershed areas setting, Weir and water gauge installation, Watershed rain gauge installation, Plot test B zone, Water gauge and exposed meteorological apparatus installation, Watershed basic condition research method, Water level and meteorological observation methods and data arrangement method o Reception of Brazilian trainee (one on a short-term basis) Flow data arrangement method o Furnishing of equipments and materials (as listed separately) 	<ul style="list-style-type: none"> o Expert dispatch (one on a long-term basis) o Reception of Brazilian trainee (one on a short-term basis) Apparatus installation in typical forest land Evaporation data arrangement method Flow data arrangement method Multiple-channel watershed hydrological survey method Penetration capacity survey method o Furnishing of equipments and materials (as listed separately) 	<ul style="list-style-type: none"> o Expert dispatch (one on a long-term basis) Hydrological and meteorological measuring apparatuses installation in typical places in the wester low land and central hilly land of the State of São Paulo Wide-area forest hydrological analysis method o Reception of Brazilian trainees (two on a short-term basis) Devastated land survey method Simplified forestry conservation structures application and improvement methods o Furnishing of equipments and materials (as listed separately) 	<ul style="list-style-type: none"> o Expert dispatch (two on a long-term basis, one on a short-term basis) Transfer of basic technical skills in the design, installation and operation of a monorail system for collecting fallen trees, ropeway system improvement research method o Furnishing of equipments and materials (as listed separately) o Reception of Brazilian trainee (one on a short-term basis)
II. Logging technical research	<ul style="list-style-type: none"> o Reception of Brazilian trainee (one on a short-term basis) 	<ul style="list-style-type: none"> o Expert dispatch (two on a long-term basis, one on a short-term basis) Transfer of basic techniques for the design, installation and operation of a simplified ropeway collection system and the tractor method of collecting fallen trees o Furnishing of equipments and materials (as listed separately) o Reception of Brazilian trainee (one on a short-term basis) Transfer of basic techniques for the design, installation and operation of a simplified ropeway collection system 	<ul style="list-style-type: none"> o Expert dispatch (two on a long-term basis, one on a short-term basis) o Reception of Brazilian trainee (one on a short-term basis) Transfer of basic skills in the design, implementation and operation of a large-scale ropeway system o Furnishing of equipments and materials (as listed separately) 	<ul style="list-style-type: none"> o Expert dispatch (two on a long-term basis) o Reception of Brazilian trainees (two on a short-term basis) Devastated land survey method Simplified forestry conservation structures application method o Furnishing of equipments and materials (as listed separately) 	<ul style="list-style-type: none"> o Expert dispatch (two on a long-term basis, one on a short-term basis) Transfer of basic technical skills in the design, installation and operation of a monorail system for collecting fallen trees, ropeway system improvement research method o Furnishing of equipments and materials (as listed separately) o Reception of Brazilian trainee (one on a short-term basis)

Field	1st year	2nd year	3rd year	4th year	5th year
III. Remote sensing technical research	<ul style="list-style-type: none"> o Reception of Brazilian trainees (one on a short-term basis) Forest accumulation analysis method Watershed topographical feature, devastation analysis method 		<ul style="list-style-type: none"> o Export dispatch (one on a short-term basis) Analysis of accumulation conditions of artificial plantations of eucalyptuses and pine trees, Analysis of topographical features, devastation conditions and others of the Paraba watershed o Furnishing of equipments and materials (as listed separately) 	<ul style="list-style-type: none"> o Export dispatch (one on a short-term basis) 	
IV. Small diameter timber application technical research				<ul style="list-style-type: none"> Expert dispatch (two on a short-term basis) Small-diameter timber sawing, processing technique improvement method, Small-diameter eucalyptus and pine timber test method Reception of Brazilian trainees (one on a short-term basis) Skills in small-diameter timber sawing and processing Furnishing of equipments and materials (as listed separately) 	
Liaison officer		One	One	One	One
Total	<ul style="list-style-type: none"> o Export dispatch: Long-term: two Short-term: two o Reception of Brazilian trainees Short-term: two 	<ul style="list-style-type: none"> o Export dispatch: Long-term: five Short-term: three o Reception of Brazilian trainees Short-term: two 	<ul style="list-style-type: none"> o Export dispatch: Long-term: five Short-term: two o Reception of Brazilian trainees Short-term: two 	<ul style="list-style-type: none"> Expert dispatch: Long-term: five Short-term: three Reception of Brazilian trainees Short-term: three 	<ul style="list-style-type: none"> o Export dispatch: Long-term: five Short-term: three o Reception of Brazilian trainees Short-term: one

4. Tentative Implementation Programé
of the Forestry Research in São Paulo Project

The Japanese Implementation Survey Team and Secretary of Agriculture, São Paulo State have jointly formulated the Tentative Implementation Programme of the Project as annexed hereto. These have been formulated in connection with I-2 of the Attached Document of the Record of Discussions between Japanese Implementation Survey Team and Secretary of Agriculture, São Paulo State on Forestry Research in São Paulo Project for its reference on such condition that necessary budget will be allocated for the implementation of the Project, and are subject to change within the framework of Record of Discussions when necessity arises in the course of implementation of the Project.

TENTATIVE ESTIMATED SCALE OF JAPANESE ASSISTANCE

Total amount

approximately 530 million yen

Amount of Machinery,
equipment and Materials
(C.I.F. São Paulo)

approximately 304 million yen

TENTATIVE SCHEDULE OF IMPLEMENTATION

	1978 Apr. Oct.	1979	1980	1981	1982	1983
Japanese Experts						
Team Leader		← 1 person		←		
Watershed management		← 1 person		←		
Mechanical logging			← 2 persons	←		
Liaison officer			← 1 person	←		
(Short Term Experts)						
Remote Sensing						
Small Diameter Timber Processing						
Others						
Training in Japan						← 11 persons
Articles, materials, etc.		*	*	*	*	*
Dispatching Survey Team		implement planning team	guidance team	guidance team	guidance team	evaluation team

5. LIST OF EQUIPMENT, MACHINERY AND MATERIALS
NECESSARY FOR THE PROJECT

Name of machinery, etc.

1. Machinery, equipment, and other materials for laboratory work

(Watershed management)

- a. Equipment for land survey
- b. Small size electric computer
- c. Instrument for measuring
- d. Sieve shaker
- e. Dryer

(Small diameter timber processing)

- a. Band saw
- b. Circular saw
- c. Planer
- d. Chipper
- e. Dust cleaner

(Mechanical logging)

- a. Equipment for land survey
- b. Equipment for measuring
- c. Instrument for drawing
- d. Equipment for tree measuring

(Remote sensing)

- a. Plotting machine
- b. Stereo scope
- c. Printer
- d. Enlarger
- e. Chemicals

2. Machinery, equipment and materials for experimental forest

(Watershed management)

- a. Automatic meteorological station
 - b. Long term recording rain gauge
 - c. Long term recording rain gauge and evaporimeter
 - d. Totalizer
 - e. Long term recording water level gauge
 - f. Water level recorder
 - g. Sunshine gauge
 - h. Long term recording heat flowmeter
 - i. Long term recording earth thermometer
 - j. Long term recording thermo-hydrograph
 - k. Long term net exchange radiometer
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Name of machinery, etc.

- l. Long term dry-bulb thermometer
 - m. Long term wet-bulb thermometer
 - n. Long term wind vane and anemometer
 - o. Infiltrometer
 - p. Automatic grain size analyzer
 - q. Generator
 - r. Pump
 - s. Tractor with dozer shovel (6t)
 - t. Tractor with dozer (6t)
3. Machinery, equipment and other materials for experimental forest
(Mechanical logging)
- a. Logging tractor (6t)
 - b. Yarder
 - c. Tools
 - d. Track with crane (4t)
 - e. Track (2t)
4. Vehicles
- a. Automobile (all wheel driving)
 - b. Light van
 - c. Track (2t)
5. Seed, fertilizer and chemicals
6. Audio-visual aid, etc. for indoor training
- a. Film projector (16mm)
 - b. ditto (8mm)
 - c. Slide projector
 - d. Tape recorder
 - e. Over head projector
 - f. Movies
7. Others
- a. Books and data
 - b. Camera (35mm)
 - c. Movie camera
 - d. Office instruments

Appendix: Record of Discussions Signed

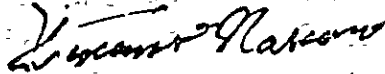
THE RECORD OF DISCUSSIONS BETWEEN THE
JAPANESE IMPLEMENTATION SURVEY TEAM
AND THE AUTHORITIES CONCERNED OF THE
GOVERNMENT OF THE FEDERATIVE REPUBLIC
OF BRAZIL ON THE JAPANESE TECHNICAL
COOPERATION PROJECT FOR THE FORESTRY
RESEARCH IN SÃO PAULO

The Japanese implementation Survey Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Dr. Hidenori Nakano, Director, Forest Influence Div., Forestry and Forest Products Research Institute, Forestry Agency, visited the Federative Republic of Brazil - São Paulo State from Nov. 26 to the Dec. 5, 1978 for the purpose of working out the details of the technical cooperation program concerning the Japanese Technical Cooperation Project for the Forestry Research in São Paulo.

During its stay in The Federative Republic of Brazil the Team exchanged views and had a series of discussions with the Brazilian authorities concerned in respect of the desirable measures to be taken by both Governments for the successful implementation of the above-mentioned Project.

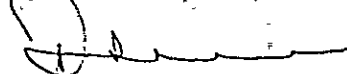
As a result of the discussions, the Team and the Brazilian authorities concerned agreed to recommend to their respective Governments the matters referred to in the document attached hereto, on the basis of the "BASIC AGREEMENT ON TECHNICAL COOPERATION BETWEEN THE GOVERNMENT OF JAPAN AND THE GOVERNMENT OF THE FEDERATIVE REPUBLIC OF BRAZIL".

São Paulo, Dec. 4 1978.

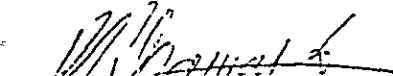


Dr. Hidenori Nakano
Head of the Japanese
Implementation Survey Team

JICA



Dr. Paulo Egydio Martins
Governador do Estado de
São Paulo



Dr. Paulo da-Rocha Camargo
Secretary of Agriculture
State of São Paulo

THE ATTACHED DOCUMENT

I. COOPERATION BETWEEN BOTH GOVERNMENTS

1. The Government of Japan and the Government of the Federative Republic of Brazil will cooperate with each other in implementing the Japanese Technical Cooperation Project for the Forestry Research in São Paulo (hereinafter referred to as "The Project") for the purpose of contributing to the appropriate watershed forest management in São Paulo State.
2. The Project will be implemented in accordance with the Master Plan which is given in Annex I.

II. DISPATCH OF JAPANESE EXPERTS

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide at its own expense services of the Japanese experts as listed in Annex II through the normal procedures under the Technical Cooperation Scheme of Japan.
2. The Japanese experts referred to in 1 above and their families will be granted in the Federative Republic of Brazil the privileges, exemptions and benefits as listed in Annex III and will be granted privileges, exemptions and benefits no less favourable than those granted to experts of third countries or international organizations performing similar missions.

III. PROVISION OF MACHINERY AND EQUIPMENT

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide at its own expense such machinery, equipment and other materials necessary for the implementation of the Project as listed in Annex IV, through the normal procedures under the Technical Cooperation Scheme of Japan.
2. The articles referred to in 1 above will become the property of the Government of the Federative Republic of Brazil upon being delivered c.i.f. to the Brazilian authorities concerned at the ports and/or airports of disembarkation, and will be

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utilized exclusively for the implementation of the Project in consultation with the Japanese experts referred to in Annex II.

IV. TRAINING OF BRAZILIAN PERSONNEL IN JAPAN

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to receive at its own expense the Brazilian personnel connected with the Project for technical training in Japan through the normal procedures under the Technical Cooperation Scheme of Japan.
2. The Government of the Federative Republic of Brazil will take necessary measures to ensure that the knowledge and experience acquired by the Brazilian personnel from technical training in Japan will be utilized effectively for the implementation of the Project.

V. MEASURES TO BE TAKEN BY THE GOVERNMENT OF THE FEDERATIVE REPUBLIC OF BRAZIL

1. In accordance with the laws and regulations in force in the Federative Republic of Brazil, the Government of Federative Republic of Brazil through the Government of São Paulo State will take necessary measures to provide at its own expense:
 - (1) Services of the Brazilian counterpart personnel and administrative personnel as listed in Annex V;
 - (2) Land, building and facilities in Annex VI;
 - (3) Supply or replacement of machinery, equipment, instrument, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than those provide through JICA under III-1 above;
 - (4) Transportation facilities and travel allowance for the Japanese experts for the official travel within the Federative Republic of Brazil;
 - (5) Suitably furnished accomodations for the Japanese experts and their families.
2. In accordance with the laws and regulations in force in the Federative Republic of Brazil, the Government of Federative Republic of Brazil through the Government of São Paulo State

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will take necessary measures to meet:

- (1) Expenses necessary for the transportation within the Federative Republic of Brazil of the articles referred to in III-1 above as well as for the installation, operation and maintenance there of;
- (2) Customs, duties, internal taxes and any other charges, imposed in the Federative Republic of Brasil on the articles referred to in III-1 above;
- (3) All running expenses necessary for the implementation of the Project.

VI. ADMINISTRATION OF THE PROJECT

1. The Secretary of Agriculture of the São Paulo State, will be responsible for the administration and implementation of the Project, and the Japanese experts will provide necessary technical guidance and advice for the implementation of the Project.
2. For the successful implementation of the Project, a Joint-Committee will be established as specified in Annex VII and will meet regularly. The committee will formulate the annual operation work plan of the Project based on the master plan in Annex I.

VII. CLAIMS AGAINST JAPANESE EXPERTS

The Government of the Federative Republic of Brazil undertakes to bear claims, if any arises, against the Japanese experts engaged in the Project resulting from, occurring in the course of, or otherwise connected with the discharge of their official functions in the Federative Republic of Brazil except for those arising from the willful misconduct or gross negligence of the Japanese experts.

VIII. MUTUAL CONSULTATION

There will be mutual consultation between the two Governments on any major issues arising from, or in connection with this Attached Document.

IX. TERMS OF COOPERATION

The duration of the technical cooperation for the Project under this Attached Document will be Five (5) years from April 1, 1979.

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Annex I

MASTER PLAN

1. The Project will be implemented in the fields of watershed management, mechanical logging, remote-sensing and small diameter timber processing for the purpose of establishing watershed forest management techniques through strengthening forestry research capabilities of São Paulo Forest Institute.
2. The Project will consist of the following:
 - a. Development of research capability of researchers through the activities of above researches.
 - b. Exchange of information and research reports.
 - c. Other activities necessary for the implementation of the Project.

Annex II

JAPANESE EXPERTS

1. Team leader
 2. Expert
 - (1) Watershed management
 - (2) Mechanical logging
 - (3) Small diameter timber processing
 - (4) Remote-sensing
 3. Liaison officer
- note 1. In the fields of above 2. (1) and (2), additional short term experts may be dispatched when necessity arises.
2. The experts of the fields of above 2. (3) and (4) will be dispatched on the short term basis.

Annex III

PRIVILEGES, EXEMPTIONS AND BENEFITS

1. Exemptions from income tax and charges of any kind imposed on or in connection with the living allowances remitted from abroad.

2. Exemptions from import and export duties and any other charges in respect of personal and household effects, including one motor vehicle per family, which may be brought into the Federative Republic of Brazil from abroad.
3. Free medical services and facilities to the Japanese experts and their families.

Annex IV

LIST OF THE ARTICLES TO BE PROVIDED BY THE GOVERNMENT OF JAPAN

1. Machinery, equipment, instruments, tools, spare parts and other materials for laboratory work.
2. Machinery, equipment, instruments, tools, spare parts and other materials for the experimental forest.
3. Specialized automobile units for experimental work.
4. Seed, fertilizer, pesticide and chemicals.
5. Audio-visual aids and articles for indoor training.
6. Books and other necessary printed matters.
7. Other necessary machinery and equipment.

Annex V

LIST OF BRAZILIAN COUNTERPARTS AND OTHER PERSONNEL

1. Project manager
2. Counterpart
 - (1) Watershed management
 - (2) Mechanical logging
 - (3) Small diameter timber processing
 - (4) Remote-sensing
3. Laboratory assistants
4. Workers for the experimental forest
5. Clerical and service personnel including typist, clerks, drivers and interpreters.

Note: Number and period of the above 3 to 5 officials and other personnel will be adjusted according to necessary from time to time.

Annex VI

LIST OF LAND, BUILDINGS AND OTHER FACILITIES

1. Office for the Japanese experts
2. Laboratories

3. Experimental forest
4. Garages
5. Warehouses for machinery, equipment and materials
6. Other land, buildings and facilities

Annex VII

THE COMPOSITION OF THE JOINT-COMMITTEE

1. Chairman: Secretary of Agriculture, São Paulo State
2. Members

JAPANESE SIDE

- (1) Team leader
- (2) Representative of experts
- (3) Liaison officer
- (4) Representative of JICA

BRAZILIAN SIDE

- (1) Director General of São Paulo Forest Institute
- (2) Project Manager
- (3) Representatives of counterparts (2)

Note:

The following representatives may attend the committee as observers:

- (1) An official of the Embassy or Consulate General of Japan and any other person designated by the Embassy or Consulate General of Japan.
- (2) Representatives of the Ministry of Agriculture of the Federative Republic of Brazil.
- (3) Representatives of the Brazilian inter-ministerial system of coordination of international technical co-operation.

