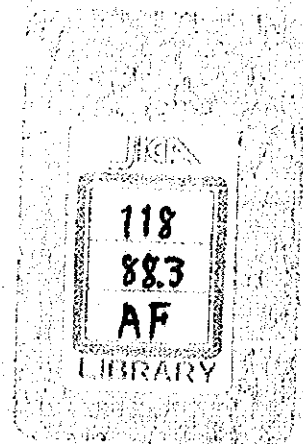


**Report of Survey  
on  
Afforestation Project  
in  
the Republic of the Philippines**

**September 1975**



**Japan International Cooperation Agency**

219  
4.33  
J

JICA LIBRARY



1046028[5]

国際協力事業団	
受入 月日 '84. 3. 23	118
登録No. 01925	88.3
	AF

1. Purpose of Survey Team

Until a few years ago, the Republic of the Philippines, with its rich forest resources represented by lauan logs, had long been the main exporter of tropical wood to Japan, though the timber production has decreased or become stagnant after accelerated logging in recent years.

The expansion of logged-over area and the denudation of the forest after shifting cultivation, have resulted in the frequent occurrences of serious flood damages in these years. Consequently there is a mounting concern in the country on the urgent need for afforestation.

The Government of the Republic of the Philippines has a deep interest in the afforestation on logged-over and denuded areas in view of conserving the land and improving the productivity of forests, and requested the Japanese cooperation in the field of afforestation.

The forest resources of the Philippines will surely have a great influence on the timber market of Japan, which has relied and will have to rely heavily on the imported timber for a considerable time to come.

In these circumstances, it should be quite necessary, for the implementation of afforestation projects in the Philippines, to advance various types of cooperation such as an intergovernmental technical cooperation and a financial and technical cooperation between Japanese private sector and the Filipino counterpart. Therefore the survey team visited the Republic of the Philippines with the following terms of reference:

To survey several candidate areas for Japanese cooperation in afforestation, collecting basic data and information

necessary for drafting a fundamental plan of the afforestation project.

To exchange views on technical aspects and organizational aspects for implementation in cooperating with the Philippines in the promotion of afforestation projects.

## 2. Members and Itinerary of Survey Team

The survey team was composed of the eight members shown below. Their itinerary is also tabulated in the following pages.

### 2-(1) Members of Survey Team

1. Takehara, hideo (Head of Mission)  
Ex-Director General,  
Government Forest Experiment Station
2. Akiyama, tomohide  
Director of Planning Department,  
Forestry Agency
3. Kōtari, katsuhiro  
Special Adviser to the President,  
J. I. C. A.
4. Hori, masayuki  
Executive Director  
Japan Forest Technical Association
5. Asakawa, sumihiko  
Chief of Tree Seed Laboratory  
Government Forest Experiment Station
6. Kuramochi, takeo  
Head of Development Division,  
Forestry Development Cooperation  
Department,  
J. I. C. A.

7. Okamoto, takakata

Chief official for international  
technical cooperation.  
International Cooperation Division,  
Ministry of Agriculture and Forestry

8. Nagatsuka, yōichi

Development Division,  
Forestry Development Cooperation Dept.  
J. I. C. A.

2-(2) Itinerary of Survey Team

- April 3 Left Tokyo by air and arrived at Manila  
(Kuramochi and Okamoto only)
- April 4- 7 Arrangement of the survey areas and itinerary at  
D.N.R., the Japanese Embassy and J.I.C.A. Office
- April 8 The other members of the team arrived at Manila
- April 9 Courtesy calls to the Japanese Embassy and J.I.C.A.  
Office
- April 10 Consultations with personnels of the Embassy and  
the J.I.C.A. Office
- April 11 Courtesy calls to FORI, UPLB (College of Forestry),  
and FORPRIDECOM
- April 12 Visit to the RP-German Training Center in Baguio
- April 13 Visit to the experiment sites in the Baguio Area
- April 14 Drive back to Manila
- April 15 Courtesty call to the Secretary of the Department  
of Natural Resources
- April 15-19 Preliminary survey of seven candidate areas for  
afforestation projects

April 20-21 Evaluation of the results of preliminary survey  
 April 22 Reporting the DNR on the findings of the preliminary survey  
 April 23 Three members of the team (Akiyama, Kotari and Okamoto) left for Tokyo  
 April 24 Courtesy call to NIA  
 April 25-27 Collecting and processing data and information  
 April 28 Courtesy call to the office of NIA in Pantabangan  
 April 29 Briefing by the district forester of the upper panpanga river basin multiple use management district, and the assistant engineer of the NIA office. Survey around the dam site.  
 April 30 Survey of the Pantabangan area  
     - May 5 Special Project Area (April 30)  
             San Jose Reforestation Project (May 2)  
             Carranglan Reforestation Project (May 2)  
 May 6 Drive back to Manila  
 May 7 Processing data and information  
 May 8 Reporting to the Embassy and J.I.C.A. office  
 May 9-11 Processing data and information, and drafting an interim report.  
             Survey of the Danao area  
 May 12 Submitting an interim report  
 May 13 Reporting to the Japanese ambassador  
 May 14 Left Manila for Tokyo

### 3-(1) Present status of forestry in the Philippines

In the Philippines a forest area covers more than half of the total land area which is nearly thirty million hectares. Besides mangrove forests (259 thousand hectares), pine forests (205 thousand hectares), and mossy forests (329 thousand hectares), a greater part of the forest land consists of dipterocarp forests with various combinations of a great number of dipterocarp species.

However, well-stocked commercial forests are only four million hectares. Another four million hectares are reproductive brushes under regeneration and three million hectares are young stock. Moreover, an open land under no intensive utilization amounts to 1,500 thousand hectares. Both forest and open lands are statistically decreasing year by year, by the conversion to agricultural land. Commercial forests have been logged over rapidly during the past two decades. In addition, Kaingin has destructed the forests and also obstructed the regeneration of logged-over or destructed area.

Since 1967, forest products have held the first place in export commodities of the Philippines. In 1971 the amount was 260 million dollars corresponding to one fourth of the total amount exported, in 1972, 226 million dollars, and in 1973 nearly 400 million dollars. The fact indicates how important rôle the forestry has held in the national economy of the Philippines. On the other hand, however, long-fiber pulp for papers is lacking and more than 100 thousand tons of long-fiber pulp are being imported annually in various forms. If the logging-over of well-stocked commercial forests is continued and not followed by reasonable regeneration, it is feared that even the domestic demand may not be satisfied in the near



future.

At present, the Bureau of Forest Development (BFD) is advancing afforestation under 89 Reforestation Projects over the whole country with the goal of 900 thousand ha plantation, but the area afforested under those Projects during the last two decades covers only 180 thousand hectares. In consequence, forest denudation has been advanced, as a result of which the flood damage in rainy season and the water shortage in dry season are getting more serious.

### 3-(2) Forestry policy

To improve the situation stated above and to rebuild forestry policies on the basis of future national benefits, "Forestry Reform Code" was promulgated in 1974, and the principles in future forestry policies and practical enforcements are clearly stated in this code.

The reorganization and reinforcement of administrative structure, reexamination of land use classification, improvement of natural regeneration for natural forests, promotion of domestic processing of forest products, progress of watershed management, expansion of artificial plantation and so on are prescribed in this code. It is recognized that the followings are especially characteristic among those features.

1. To provide various incentives to private sectors in order to promote industrial plantation.
2. To improve the counter-measures for Kaingin, which has been a serious barrier to forest regeneration.

Based on this code, the following various enforcements are being advanced to maintain and improve forest resources.

1. Promotion of natural regeneration under a given standard.
2. Afforestation for an open land.
  - a: Promotion of Reforestation Projects in national forests.
  - b: Promotion of Special Projects for specified areas.
  - c: Improvement of incentives for private sectors to promote industrial plantation. (Extension of the period for land lease, delayed payment of rent, etc.)
  - d: Encouragement of tree farming to promote small-scale afforestation.

The mission realized that in various parts of the Philippines there is a large area where afforestation is needed or a large open land where afforestation can be done. To accomplish such a large area of afforestation, it is very desirable to introduce both domestic and foreign funds and techniques. It is especially expected that incentives will be improved much more, so that private sectors can participate in afforestation with greater interest.

In order that the Reforestation Projects under the BFD are advanced efficiently, the sufficient budget to meet their plan should be prerequisite. At the same time, however, it is also expected that particular concern should be given to efficient operation of budget, so that planting works can be carried out in time.

### 3-(3) Present status of silvicultural techniques

#### 1) Regeneration of natural forests

A typical broad-leaved forest under the tropical climate with abundant rainfall is the natural forest consisting mainly

of the species in Dipterocarpaceae. Dipterocarpaceae includes a great number of species, and the composition of dipterocarp forests is very complicated and variable. In this kind of forest, the species in Genus Shorea are the most popular and those species can be utilized for various uses. However, the longevity of their seeds is very short, and artificial regeneration including the processes of seed collection, sowing, growing seedlings, and planting is very difficult. Therefore, those species are obliged to rely on natural regeneration, which is not always successful after logging-over. From the viewpoint of world forest resources, it is a very serious problem that there is very little information concerning the natural regeneration of those species. Both FAO and IUPRO are greatly concerned about the problem as the subject to be solved as soon as possible.

In the Philippines, there has been the regulation in which trees smaller than a given diameter should be left uncut, and recently the diameter limit is 70 cm. But an enforcement recommends to leave even trees larger than 70 cm, if they are still capable of growing, by strict marking. It is a kind of selective logging which seems to be almost ideal. But careful preceding survey, precise confirmation in the field, and appropriate direction are required to carry out such a selective logging strictly. Moreover, if the standardized way of selective logging is imprudently forced even to the place where artificial regeneration is more suitable, the endeavor to advance large-scale plantation may be disappointed.

In pine forests, successful regeneration by natural seeding may be expected with 16 to 20 mother trees left in a hectare. However, there seem to be many cases in which regenerated

seedlings or saplings are damaged by surface fire and eventually result in grassland.

## 2) Artificial regeneration

Practical possibility in artificial regeneration is being secured for some of fast growing species and Benguet pine. Among them, *Albizia falcata* seems to be especially hopeful according to the performance of trial plantations which are not rare in Mindanao. The growth of *A. falcata* proves to be highly good and the technical information about the species is being accumulated. In most cases, however, existing plantations are limited on very fertile sites, so that no information is available to predict the yield in large-scale plantation.

Growth pattern under different climatic and edaphic conditions, planting space, and time and degree of thinning remain to be solved, and relating practices have not been systematized yet. To inspect the plantations established so far, there is a considerable difference in tree form or growth among individuals, which indicates the necessity to start selection as soon as possible.

At present, the major use of fast growing species is pulp material, although an increasing attention is paid to the uses as furniture, veneer, or core material. In the Philippines, as stated already, long-fiber pulp needs to be imported, so that much more attention should be paid to regeneration of conifers. *Pinus kesiya* which is now used for plantation is distributed above 600 to 700 m a.s.l. in central Luzon, so that further experiment should be required for its growth at lower elevation. In the Philippines there are few examples of trial plantation with another native pine, *Pinus merkusii*, and exotic tropical

pinus. As any of those pines seems to be hopeful for future large-scale plantation, it is necessary to survey the possibility of afforestation with them and to establish their silvicultural techniques.

There are some plantations of useful broad-leaved species such as *Tectona grandis* or *Swietenia macrophylla*, which suggest some possibility of afforestation with them. However, the history of their planting is still very short and the success is not sure so far. In this connection the mixed planting with some of fast growing species or pines may be worth examining.

For artificial plantation, tentative information for site evaluation and yield prediction should be prepared by analyzing the growth in existing plantations of the species concerned. In addition, however, it is desired that a kind of center for systematic studies and surveys will be established at least both in central Luzon with a severe dry season and in southeastern Mind<sup>a</sup>nao where rainfall is more or less evenly distributed throughout the year.

#### 3-(4) Summary of surveyed areas

The mission investigated four areas proposed by the Philippine Government and also three areas Japanese private sectors are interested in.

Summarized results on seven areas are as follows:

##### 1) Pantabangan area

The area covers the northeastern part of Nueva Ecija Province, Central Luzon, where a multi-purpose dam has recently been completed for irrigation, flood control, and electric power. The reservoir covers about 8,000 hectares, and the

total catchment area for the reservoir amounts to nearly 80,000 hectares.

In the west of Pantabangan area, there is Talavera watershed which is also a branch of Pampanga River. Including the adjacent Talavera watershed, the Upper Pampanga River Basin Multiple-Use Management District covers about 150,000 hectares.

In the area, there are two Reforestation Projects (Carranglan and San Jose R.P.) under BFD. There is also the so-called Special Project under the Department of Natural Resources, which covers a part of Carranglan R.P. along the north-eastern side of the reservoir. In addition, there is a joint project between the National Irrigation Administration and UNDP, which seems to aim at afforestation in the area surrounding the reservoir.

#### 1. Natural environments

**Climate:** Annual average temperature is 28°C, and annual rainfall is 2,400mm according to the reference (A Report on the Upper Pampanga River Project, 1966). The basin is separated by Sierra Madre Mountains from the eastern Luzon facing to the Pacific Ocean. There is a strict dry season ranging from November to May. In the basin, the east wind appears to surpass during the dry season.

**Topography:** The southernmost of the area is about 100m a.s.l. and connected with the central plain. The elevation in the area ranges from 200m to 1,800m. The area below 1,000m a.s.l. is gently rolling, and the slope is about 15° for the area between 200 m and 700m. On the other hand, the higher part is mountainous with steep slope. According to the reference cited above, the maximum water

surface of the reservoir is 235.5m a.s.l. In Talavera watershed, especially in its west side, slopes are rather steep and some of stream beds have been devastated. But most of the slopes look rather stable.

Geological features: Most parts of the area are covered with thick layers of conglomerate and shale derived from tertiary formation, but some parts are intruded by diorite and others. Lower part around Carranglan is alluvial.

Soil: Soil is a kind of Ultisol whose lower layer is reddish brown and characterized by clay accumulation. It is most acidic in this province, although not so extreme.

Vegetation and land use status: Uppermost part is mossy forest, below which there is a natural forest where dipterocarps are dominant. It is said that there are many oak trees in the upper part of dipterocarp forest zone. Lower part of the existing natural forests seems to have been logged over, at least, once. There is a natural distribution of *Pinus kesiya* in the northern part, adjacent to Nueva Vizcaya Province, higher than 700 to 800m a.s.l. Most part of the basin lower than 500m a.s.l. is a grassland. The grassland covers a vast area amounting to nearly 40,000 hectares, and a part of it is utilized for pasturing. Pasturing area is burned at the end of dry season.

Talavera watershed seems to have been exploited a little later as compared with Pantabangan watershed, and a part of the area subjected to shifting cultivation (kaingin) is still left as a grassland, which is scattered on a steep in a size of about 100 hectares. Including both water-

sheds, it is estimated that an open land to be afforested reaches nearly 50,000 hectares.

In the area, there are some plantations of Benguet pine, teak, and so on under two Reforestation Projects, the results of which indicate a little lower productivity in the area than in the southeastern Mindanao. The data obtained so far are not enough yet to start large-scale plantation.

## 2. Social and economic conditions

**Transportation:** The area is about 200 km far from Manila via main highway. The road to Baler on the Pacific coast in the east is now under construction, and after completion the distance via the road will be about 80 km. It is said that around Baler timber processing base may be founded in the future. Casiguran located in the northeast of Baler is a good port, but a little far from Pantabangan area.

**Population:** Population in Carranglan and Pantabangan is 14,000 and 9,000, respectively. In Talavera watershed, there are also several small communities scattered around. It is said that in the area there seem to be enough laborers available for large-scale afforestation.

**Industries:** There is no remarkable industry besides rice agriculture and pasturing around Carranglan, road construction around Pantabangan, and logging in natural forests of limited scale. However, the area around the reservoir could be a good base for recreation.

## 2) Davao area

In the southeastern Mindanao, there are still natural



dipterocarp forests, where timber of good quality is being produced. Consequently, concessions are set up in many of well-stocked forests and many private sectors are exploiting the area. In the area, Davao del Norte province is typical. In the watersheds of Libuganon and Sang Rivers, large-scale farms are established on alluvial bed along streams and large-scale forest concessions are established in hilly and mountainous areas. Two concessioners of Aguinaldo and Alcantara are managing nearly 300 thousand hectares including alienable and disposable areas.

### 3) Mariveles area

The proposed area covering about 15,500 hectares, is situated in the southern foothill of Mt. Bataan in the southern half of Bataan Peninsula, Bataan Province. South of the area, the Bataan Export Processing Zone is being constructed. The afforestation in the area aims mainly at water supply for the industries and soil conservation for the EPZ. In the area, surface soil has become sterile by heavy logging after the war, but the land productivity does not seem to be so low.

### 4) Bago area

The proposed area is located in Negros Occidental Province, and extends over 53,000 hectares. The area ranges between 700m and 1,300m a.s.l., and consists of a little steep hilly land. Through heavy and rapid logging-over, the area has been denuded. Therefore, afforestation is required mainly for watershed management having a major purpose of land conservation.

### 5) Bukidnon area

The proposed area lies over both Malaybalay and Impalutao municipalities in the northeastern Bukidnon Province. The area is divided into two parcels, and the total area reaching nearly

60,000 hectares is an open land. The area ranging between 600 and 900 m a.s.l. consists of rolling hills. The area is not far from the highway that ties Cagayan de Oro with Davao, and the distance to Cagayan de Oro is about 70 to 100 km. At present, however, there are no roads connected to the highway.

Greater part of the area is leased for pasturing. Fast growing species and some pines are probably suitable for large-scale plantation, but there is some doubt concerning soil productivity in the area having been subjected to pasturing.

The provincial development authority in the area believes that afforestation is much more profitable than pasturing, and so they have active afforestation programs. For practical planting, a kind of contract system is under discussion to assure planting and earlier tending.

#### 6) Arasasan

The area is located in Surigao del Sur Province of the northeastern Mindanao. The area faced to the Pacific Ocean has high precipitation and consists mainly of hilly land ranging 50 to 300 m a.s.l. Nearly 21,000 hectares of the concession area reaching 50,000 hectares are specified as alienable and disposable area. In order to advance afforestation on private land including A & D area, a joint-venture between the Philippine and Japanese private sectors has been just established, and they have already started a small-scale plantation of *Albizia falcata*. The rôle that afforestation plays in the development of the area is considered to be really great, because the land productivity around the area is estimated to be considerably high. It is probably characteristic in this area that planting is done on leased land under direct management.

#### 7) Samar area

The area is located in Samar Province, where industrial plantation is intended under the Philippine and Japanese joint-venture. Land productivity is medium, and probably lower than that in Mindanao. The area is plateau-like with the elevation around 200 m a.s.l. Afforestation should play an important rôle in the development of the area, because there are no particular industries around the area at present.

Eventually, Pantabangan area was preferred as the center for future cooperative projects, from the viewpoints of both industrial timber production and water conservation.

#### 4. Recommendations for afforestation project

##### 4-(1) Fundamental directions for Pantabangan area

In the Pantabangan watershed, a multi-purpose dam has been just completed. It aims at water supply for irrigation, flood control, and power generation. In the catchment area of the dam reservoir there is a vast range of open land, which should be urgently covered by forests. The established plantations should require the balanced management from the viewpoints of both watershed conservation and timber production. Therefore, following fundamental directions will be proposed to implement afforestation projects in the area.

1) The vast open land should be covered with forests as soon as possible in order to restore soil productivity and to improve water source. To meet these aims, prompt afforestation should be done with fast growing species such as *Albizia falcata*,

*Leucaena pulverulenta*, etc.

- 2) Large-scale plantations consisting of a single species or fast growing species alone are not safe from the viewpoint of forest protection for the long-term, probably being susceptible to disease or insect. To enhance the ecological stability of plantations and also to meet the future demand, *Pinus kesiya*, exotic tropical pines or broad-leaved species for lumber production should be taken into account for mixed planting at suitable sites.
- 3) After examining the performance of the first plantation, it is worth considering to enlarge the area to plant pines or the broad-leaved species for timber production after thinning or after harvesting of the first plantation.
- 4) Natural forests of broad-leaved species remaining at higher elevation should be preserved in the present conditions as much as possible. For the place where forest condition has been somewhat destructed and natural regeneration is not hopeful, artificial regeneration should be examined. Permanent reserve forests should be established for the area important from the viewpoint of vegetational composition.
- 5) To assist the livelihood of residents in the area, a special consideration should be given to the development of pomiculture etc.

#### 4-(2) Technical problems

The above-mentioned afforestation project should be implemented step by step, solving the technical problems as follows.

1) Species trials and the establishment of silvics for hopeful species.

Around the area, the experiences for afforestation have been limited and also little information about afforestation has been accumulated. Therefore, it will certainly be desirable to examine appropriate species and to establish their silvics for the area. Experiments and surveys should be done on nursery practices, planting method, spacing, thinning, site evaluation, and yield prediction mainly with the following species.

1. Fast growing species: *Albizia falcata*, *Leucaena pulverulenta*, *Gmelina arborea*, *Casuarina equisetifolia*, *Eucalyptus* spp., etc.
2. Pines: *Pinus kesiya*, *P. merkusii*, *P. caribaea*, *P. elliotii*, *P. oocarpa*, etc.
3. Broad-leaves species: *Tectona grandis*, *Swietenia macrophylla*, etc.

2) Problems in connection with afforestation practices

1. Techniques to protect plantations from fire.

Fire resulting from Kaingin, burning for pasturing, or carelessness seems to be the most serious barrier for afforestation in the area. To prevent the damage due to such a fire, it will be most effective, for the present, to construct fire break belts and/or forest-road networks with the combined aim of fire break, and/or to improve fire-fighting equipments. At the same time, it will be also necessary to educate the local people for the importance of fire control, and to improve fire fighting system in their responsibility.

## 2. Techniques to protect plantations from wind

During the dry season the east wind appears to surpass in the area. The way to decrease the wind effect should be useful in keeping soil from drying-up during the dry season, in improving the survival of planted materials, and eventually in promoting their growth. It will be needed to know the direction of wind, to examine the direction of planting or cutting row, and also to examine the establishment of windbreak belt. To establish windbreak belt, fertilization or ploughing may be tried to promote the growth of planted materials.

## 3. Techniques to prevent soil erosion

In the catchment area of the reservoir, generally speaking, soil erosion is still at the earlier stage and not so serious, at least, at present. But a surface erosion has just started on some steep slopes.

In Talavera watershed, on the other hand, there are not a few devastated streams where soil erosion has already occurred. It should be worthwhile to examine the construction of check dams for devastated stream beds and the terrace work for some steep slopes.

Continuous survey is needed to investigate the effect of afforestation on soil erosion control, flow control, or restoration of soil productivity.

## 3) Devices for intensive forest management

For the successful establishment and subsequent reasonable management of large-scale plantations, careful planning and reliable implementation are required. Basic maps on which to base various plans or statistical computation are necessary to

accomplish the aims stated. On the basic maps, a forest area should be divided into appropriate blocks and smaller compartments according to practical management<sup>Y</sup> factors. Various operations should be done for those blocks and compartments. An appropriate size of the compartment for artificial plantation may be 200 to 500 ha, and ~~the~~ for natural forests it may be 1,000 to 2,000 ha.

Compartments with the appropriate size stated above should be specified in the field and used as the unit for intensive operation.

#### 4) Improvement of operational facilities for afforestation

It will be necessary first to expand and improve forest nurseries, then to introduce mechanization into the various operations of afforestation, and to construct and improve forest-road network, etc.

#### 4-(3) Afforestation program recommended for Pantabangan area

In spite of elaborate activities of existing projects, sufficient information has not been accumulated yet even for the species having been used so far. Therefore, it will be necessary to solve the technical problems as mentioned in the previous section before starting large-scale plantation. Efficiently to advance the program concerned, the following three phases will be proposed.

##### (Phase 1) Species and provenance trials

For various species as described above, nursery practices will be established, and also the possibility of afforestation with some important species will be examined through small-scale trial plantation at the selected places with comparatively

good site conditions.

For some species, with which more experiences have been accumulated, provenance trial and pedigree selection with special reference to growth and stem form will be started.

Experimental plots will also be set up with major species, in order to examine their growth pattern for various environmental classes. Tentative classes proposed will be as follows:

Elevation: below 500m, 500 - 700m and above 700m

Soil: colluvial, residual and eroded soil; or deep soil and shallow soil

Slope with reference to wind direction: east slope and west slope

Additional experimental plots will be established to examine planting method, spacing, thinning, or harvesting. Nurseries will be well-arranged in order to supply enough seedlings for the plans stated above.

(Phase 2) Systematization of individual techniques and examination of economic feasibility

Systematization of individual techniques will be investigated by examining earlier results of above-mentioned trials and by assembling the best individual techniques at the stage.

In addition, management model plantations will be established to examine managerial factors.

(Phase 3) Large-scale plantation

As soon as a hopeful possibility (or a fair prospect) is estimated from the experiments described above, large-scale plantation both for water conservation and timber production which is capable of sustained yield will be started for the



whole area.

The recommended large-scale plantation will be started before establishing effective countermeasures to protect plantations from the damages due to diseases, insects, fire, or wind, although various preliminary trials are to be done. Therefore, the whole project recommended may be considered as a test case. It is certainly necessary to examine the progress of the project carefully and to apply the results for subsequent implementation.

In addition, the technical or managerial systems established in the area will probably be adaptable also to the afforestation or restoration of soil productivity in a vast open land of northern Luzon amounting to 500 thousand to 1,000 thousand hectares.

In the phases stated above, no device is mentioned for forest damage due to diseases or insects. Through those phases, however, such a damage is likely to happen. The damage should be prevented as soon as possible, whenever it occurs or through the preceding survey for outbreak prediction.

#### 4-(4) Organization to implement the afforestation project

To accomplish such a big project of afforesting 50 thousand hectares for a short period as proposed, a very close cooperation between government and private sectors is certainly needed. As described already, the afforestation project in the Pantabangan area has the public character and the solution of various technical matters is required at the beginning, which suggests that the earlier part of the project should desirably be implemented by governmental organization. Based on the results in the earlier phase, it should be most efficient

that the major part of the project will be completed by the techniques and funds of private sectors. There should be various ways in which private sectors may participate in this project, but a kind of public organization under the leadership of the Philippine government might be the most appropriate in implementing the project in view of the character of this project.

4-(5) Tentative yearly plan and necessary expenses

The yearly plan for the phases proposed above is tentatively figured out in the following table. This tentative yearly plan will be revised by the detailed results of the forthcoming planning survey. Two or three times of the period proposed may be required to obtain more reliable prospects from various trial plantations, but the period {proposed} has been shortened as much as possible because the afforestation in the area is so urgently needed. Therefore, the plan of the later phases may be revised, whenever necessary, through continuous observation of the performance of trial plantations.

According to the present price level, the following will be the estimated approximation of the total expenses required for the afforestation of 50 thousand hectares during 12 years as shown in the yearly plan.

Labor for raising seedlings and planting	4,000 million yen
Labor for others	500 million yen
Equipments and Supplies	2,000 million yen
Office and relating facilities	400 million yen
General administration	1,100 million yen
<u>Total</u>	<u>8,000 million yen</u>

TENTATIVE SCHEDULE OF AFFORESTATION PROJECT

YEAR	(UNIT: Hectares)												TOTAL		
	1	2	3	4	5	6	7	8	9	10	11	12			
PHASE 1	FG.	100	100	200	-	-	-	-	-	-	-	-	-	-	400
	PN.	-	200	200	200	300	-	-	-	-	-	-	-	-	900
	BL.	100	100	100	300	200	-	-	-	-	-	-	-	-	800
	T.	200	400	500	500	500	-	-	-	-	-	-	-	-	2,100
PHASE 2	FG.		1000	1000	1000	1000	-	-	-	-	-	-	-	-	4,000
	PN.		-	500	500	-	-	-	-	-	-	-	-	-	1,000
	BL.		-	-	500	500	-	-	-	-	-	-	-	-	1,000
	T.		1000	1500	2000	1500	-	-	-	-	-	-	-	-	6,000
PHASE 3	FG.						1000	1500	2000	2000	3000	3500	3500	3500	25,000
	PN.								900	1500	1500	2000	2500	2500	13,400
	BL.								500	500	500	500	500	500	3,500
	T.						1000	1500	3400	5000	5500	6000	6500	6500	41,900
TOTAL	FG.	100	100	1200	2000	2500	3000	3000	3000	3500	3500	3500	3500	3500	29,400
	PN.	-	200	200	700	800	900	1500	1500	2000	2000	2500	2500	2500	15,300
	BL.	100	100	100	300	700	1000	500	500	500	500	500	500	500	5,300
	T.	200	400	1500	3000	4000	4900	5000	5500	6000	6000	6500	6500	6500	50,000

\* FG. : fast growing species  
 PN. : pines  
 BL. : broad-leaved species  
 T. : total

