4. 結論と提言

本技術協力事業の10年間の諸活動を，プロジェクトの現況やこれまでの資料などによって検討したが，討議々事録に定められた目標は，いくつかの例外を除いてほぼ予定どおりに実施されており，例外も，協力期間の不足，植栽木の予想外の生長不良など，やむをえない理由によると考えられるものがほとんどである。このように順調に協力事業が進めてこられたのは，ひとえに日比両国の専門家，カウンターパート，および関係者たちの努力と協力によっていると思われる。

最後に，今回の調査結果を要約して結論とし，それにもとづく提言を行いたい。

4－1　森林造成技術

主として早成樹種による試植林，試験林の造成を通して，熱帯草原における森林造成のための諸技術の開発・改良を進めてきた。この間に造成された試植林，試験林は6,200haを越えており，目標とされた8,100haの約80%に達している。開発された技術は，逐次テクニカルノートとして速報的にまとめられ，協力事業の実地でも活用されてきたが，プロジェクトの終了前に，技術報告書として総括整理するべく，現在作業が進行している。一部はいわゆるマニュアル（技術指針書）の形い編集して公刊が予定されている。

しかしながら，一部の技術の有効性を実証するにはなお数年が必要であり，また次項でふれる治山的工法と組合わせた技術開発も必要である。さらに，一部の造林地はかなり良好な成績を示しているが，その中心が外来の早成樹種で，一般に寿命が短いといわれていることから，原産の有用な長伐期樹種に更改していくための技術開発が急がれる。

4－2　森林保全技術

森林保全研修センターの活動の中心は，比国内各層の研修生にたいして所定の研修を行うことにおかれてきており，それらの研修は適切，効果的に進められてきたと評価されている。

各種治山工は主に研修の材料として構築されてきたため，ほとんどが研修センターの近くに偏在してはいるが，併せて，技術移転の目的にも効果的に活用されてきた。各種工法の開発・改良に当っては，とくにフィリピンで普及しうるものであることに狙いをおいてきており，それなりの成果を得てはいるが，それらの実証を含めて，今後に残された課題も多い。

4－3　研　修

技術研修については，計画をむしろ上廻るほどに円滑，効果的に実施されてきたが，今後は次の点を研修に組入れることが望ましい。①過去10年間に開発，改良された草原造林に関わる諸技術，②治山的工法と組合わせた森林造成技術。

4－4　社会林業

現行のプロジェクトが終了すると，これまで地域の住民に提供されてきた雇用の機会が著しく減少することになる。このところの数年，彼等の所得は著しく向上しており，その生活水準を維持するために，何らかの収入の道を他に求めなければならないことになるだろう。その一つとして，本プロジェクトで造成されたものも含め，森林の不法伐採が危惧されるし，また一層の火災の危険にさらされる懸念もある。

現存する森林を適切に保護し，また新たな森林造成を効果的に進めていくためには，地域住民の協力を得ることが是非とも必要であり，あらゆる方法で，地域住民の森林に対する意識，関心を育てていかなければならない。このような視点から，地域住民を巻きこんだ，森林を造成，保護，育成する仕組みを開発することが必要である。

以上のような結論をふまえ，日比合同評価チームは，現行プロジェクトの終了後直ちに，下記のような視点にたった新しいプロジェクトをつくるように，それぞれの政府に勧告することで意見の一致をみた。なお，予想される技術開発の性格上，新プロジェクトの協力期間は5年以上であることが望ましい。

新しいプロジェクトに含められるべき項目

① 樹種更改技術（保育，保護を含む）の開発，改良
② 治山工法と組合わせた森林造成技術の開発，改良
③ 森林保全技術の開発，改良
④ 森林造成，森林保混，森林保全の技術的研修
⑤ 地域住民を巻きこんご森林造成，森林保護方式の開発，改良
⑥ 前記各項を実施することによる総合的流域管理体系の確立

THE REPORT OF THE JOINT EVALUATION
ON
THE FORESTRY DEVELOPMENT PROJECT OF THE PANTABANGAN AREA, THE PHILIPPINES

December 1986

THE REPORT OF THE JOINT EVALUATION

ON

THE FORESTRY DEVELOPMENT PROJECT OF THE

PANTABANGAN AREA, THE PHILIPPINES

With still seven months to go before the termination of the cooperation period on July 23, 1987, the Joint Evaluation Team (hereinafter referred to as "the Team") which consisted of the Philippine team headed by Mr. Jose L. Lechoncito, Chief of Reforestation and Afforestation Division, Bureau of Forest Development, and the Japanese team headed by Dr. Sumihiko Asakawa, Leader of Japanese Evaluation team dispatched by Japan International Cooperation Agency, was organized for the purpose of reviewing the achievements of the Project and submitting its findings and recommendations on the matter.

After the visit to the Project site and a series of discussions with the Philippine/Japanese staffs concerned of the Project, the Team held the final evaluation meeting in Quezon City, on December 8, 1986.

As a result of the meeting, the Team agreed to present its evaluation report to their respective Governments and accordingly to recommend the matter referred to in the attached document herewith.

The team sincerely hopes that this report will be fully evaluated and its recommendations be looked into by both govrernment authorities concerned

Quezon City, December 8, 1986.

Mr. Jose L. Lechoncito
Head of Philippine
Evaluation Team

Dr. Sumihiko Asakawa
Leader of Japanese
Evaluation Team

THE REPORT OF THE JOINT EVALUATION

ON

THE FORESTRY DEVELOPMENT PROJECT OF THE

PANTABANGAN AREA, THE PHILIPPINES

December 1986

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I INTRODUCTION

1. Purpose

The Project was started in 1976, and through the amendment of the Record of Discussions in 1982, is to be terminated in July 1987.

The purpose of the Joint Evaluation Team, therefore, is to finally evaluate the implementation/achievements of the Project based on the objectives as stipulated in the Record of Discussions to find out whether the same have been totally or substantially carried out. In addition, in order to identify the useful techniques developed and improved in the project and to promote the dissemination and transfer of the said techniques, it aims to recommend to both governments necessary measures to be taken by the Philippine and Japanese sides after the termination of the project.

2. Members

(1) Japanese Members

DR. SUMIHIKO ASAKAWA	Silviculture (Leader)	Director Silviculture Division Forestry and Forest Products Research Institute
MR. SATOSHI WATANABE	Cooperation Planning	Chief International Forestry Cooperation Office Private Forest Department Forestry Agency
MR. TSUTOMU MAKI	Forest Conservation	Senior Planning Officer Research and Extension Division Forestry Agency

MR. YUKITOSHI HINO	Technical Result	Staff Engineer Japan Overseas Forestry Consultants Association
MR. YUICHI SATO	(Coordinator)	Staff Forestry Development Division J I C A

(2) Philippine Members

MR. JOSE L. LECHONCITO	Chief, Reforestation and Afforestation Division
MR. GERARDO CABREROS	Chief, Forest Protection and Law Enforcement Division
MS. AUREA OJERIO	Chief, Management Information System Staff
MR. GERUNDIO PANONG	Chief, Watershed Management Division
MR. JOSE GALLANOSA	Chief, Budget Section Finance Division

3. Itinerary

Nov.	27 (Thu)	Japanese Team arrives in Manila
	28 (Fri)	Courtesy call on OIC Director of BFD
		First Joint Meeting
	29 (Sat)	Internal Meeting
	30 (Sun)	-do-
Dec.	1 (Mon)	Manila - Pantabangan Project Site
		Inspection
	2 (Tue)	-do-
	3 (Wed)	-do-
		Pantabangan Project Site - Manila
	4 (Thu)	Internal Meeting
	5 (Fri)	Second Joint Meeting
	6 (Sat)	Internal Meeting
	7 (Sun)	-do-
	8 (Mon)	Final Joint Meeting
	9 (Tue)	Reporting
	10 (Wed)	Japanese Team leaves for Tokyo

II BASIC INFORMATION

1. Project Background

(1) The completion of the multi-million peso Pantabangan Dam in Nueva Ecija, brought to light the many problems that had been existing in the area. The most imminent and critical is the watershed which is mostly grassland that gets burnt every year and rapidly deteriorating, threatening siltation of the dam. The need to reforest it has become a national clamor because the life of the dam, which is tremendously affecting national economy, is at stake.

To reforest 50,000 hectares of openland watershed which had been devoid of trees for a long time is a herculean task and requires a large amount of money. The soil is infertile and acidic and with a severely disrupted micro-climate, high inputs are needed to insure survival of trees planted. Nevertheless, the government has to face the situation. The dam is there and the annual occurrence of devatating floods in Central Luzon is a national concern.

(2) The government had proceeded to rehabilitate the watershed and embarked on a concerted effort to attain this objective. It was at this time that the idea of obtaining technical assistance to augment re-afforestation efforts was conceived.

2. Details of Project Establishment

(1) In May 1973, the then Secretary Arturo Tanco of the Department of Agriculture and Natural Resources wrote Ambassador Urabe of the Japanese Embassy exploring possibilities of a joint technical assistance project between the governments of the Philippines and Japan. Secretary Tanco followed up his request of assistance during his visit to Japan in September 1973, discussing the matter with Mr, Sakurauchi, the then Minister of Agriculture and Forestry. The result of the discussion was formalized a month later by a official letter of the Philippine Government through Japanese Embassy. In February and March 1975, follow-ups were made requesting Japan to send a forestry survey mission.

The first survey team organized to conduct the pre-feasibility studies by the Japan International Cooperation Agency (JICA) arrived in Manila in April 1975. The team discussed with Department of Natural Resources (DNR) and Bureau of Forest Development (BFD) officials on the technical, organizational and institutional aspects of the proposed project.

(2) Preliminary negotiation took place in October 1975, between the Philippine officials represented by DNR and BFD and Japanese side by the members of the first survey mission. It was agreed that the mission's findings/suggestion on re-afforestation scheme be adopted and the involvement of the private sector with the project be set aside.

Final negotiation took place in the conference room of the BFD Director on 16 June 1976. The draft of the Record of Discussions (R/D) formulated by the Japanese team with assistance from BFD officials became the basis of discussion. It was agreed by the two panels to adopt the general provision of the Colombo Plan Technical Cooperation Scheme regarding medical/dental services, custom duties and taxes of experts and accidents claims. Before the meeting ended, the Department of Foreign Affairs representative requested the Japanese panel to submit their estimates of the project cost.

(3) The signing of the Record of Discussions on June 18, 1976 by Director Edmundo V. Cortes of BFD and Mr. Katsuhiro Kohtari, head of the Japanese Team, JICA, formalized and activated the Project. On November 24, 1976, two Japanese experts arrived to compose the initial pool of experts detailed in the Project. A Joint Committee composed of representatives from various agencies was organized to form the Project's policy-making and policy-coordinating body. The Project's organizational structure became operational immediately with the appointment and detail of project personnel.

3. Project Extension

(1) During the negotiation phase of the Project, it was agreed that the technical cooperation would be governed by the Record of

Discussions for the first two years and thereafter by the Bilateral Agreement. The Bilateral Agreement, however, was not concluded by the two governments until project termination in 1982. During the last five years 1978-82 the Record of Discussions was extended eleven times in order to prevent a hiatus in project implementation , with the hope that the Bilateral Agreement would soon be approved by the two governments.

Meanwhile, Japanese grant aid for the Forest Conservation Training Center was realized with the signing of the Exchange of Notes between the both countries in August 1978, and the construction of the Training Center was completed an subsequently turned over to the Philippine government in September 1982.

(2) In July 1982, the implementing agencies, BFD and JICA, were aware that the goal of the Project was only half completed and technical cooperation at the Forest Conservation Training Center had been needed, extended and included in the Project in order to promote technical cooperations on afforestation and forest conservation together and realize their objectives. The agreement was embodied in the Record of Discussions signed on July 24, 1982. Then the name of Project was changed to the Forestry Development Project of Pantabangan Area from the Technical Cooperation Project for the Afforestation of the Pantabangan Area.

The Forestry Development Project of the Pantabangan Area consists of Sub-Project I and Sub-Project II. The former is for Afforestation and the latter is for forest conservation.

(3) In September 12, 1984, the scheme for the establishment of an upgraded forest firefighting system was realized with the signing of the Exchange of Notes between the Governments of the Philippines and Japan which indicated the granting of ¥103 Million for the purpose. By January 1986, all the equipment for the scheme arrived at the project site.

III OBJECTIVES

A. Sub-Project I: Afforestation Technical Cooperation Center

Objectives of the Sub-Project I are described in the Annex 1 the Master Plan of the Project of the R/D as follows:

1. The purposes of this Sub-Project are to develop and improve afforestation techniques and to train Philippine counterparts and other technical staff for the afforestation of the Pantabangan area through the establishment of the Pilot Man-made Forest and nurseries.

2. The Pilot Man-made Forest will be composed of trial plantations in the first phase of about 1,300 hectares in size and of test plantations in the second phase of about 6,800 hectares in size.

3. The activities of the Afforestation Technical Cooperation Center well be as follows:

a. Development and Improvement of Techniques on Afforestation

i) Specific Techniques

(1) Trial in techniques on selecting species
(2) Trial in nursery techniques
(3) Trial in planting techniques
(4) Trial in countermeasures against forest fire and disease, insect and meteorological damages
(5) Trial in techniques on forest road construction

ii) Management Techniques

(1) Systematization of silvicultural and forest protection technique
(2) Economic assessment of large-scale afforestation

(3) Test and research on the environmental implications of afforestation
(4) Research and study on the social implications of afforestation
(5) Other necessary studies and research

b. Technical Training on Afforestation

i) Management Techniques

(1) Planning of afforestation project
(2) Techniques for systematization of nursery and plantation work
(3) Techniques for designing and managing forest roads
(4) Techniques for the application of machine power
(5) Techniques for prevention of forest fire, disease, insect and meteorological damages.

ii) Working Techniques

(1) Techniques of nursery and plantation work
(2) Techniques of forest road construction
(3) Operation and maintenance of machinery
(4) Techniques of forest protection

B. Sub-Project II: Training Center for Forest Conservation

Objectives of the Sub-Project II are described in the Basic Plan* of the Project as follows:

*The Basic Plan was arranged in conformity with the Master Plan of the Project (Annex 1 of the R/D) and submitted to BFD Director from Chief of the Japanese Consultation Team for the Project in October 1982.

1. Purposes

The purposes of this Sub-project are to conduct theoretical and practical training for forestry technicians and foresters and to develop and improve forest conservation techniques. To accomplish these objectives, the following will be undertaken.

2. Technical Training on Forest Conservation

Utilizing the training center, the Sub-Project will transfer forest conservation techniques to the trainees. The training courses are divided into two: the Ordinary Course and the Senior Course, the main subjects are general and basic knowledge, and applied knowledge and skill, respectively.

(1) Ordinary Course

i) Forest Conservation in the Middle Level Forestry Technicians Training Program

Objectives : To provide the skills and knowledge of forest conservation suitable leaders in the field of forest conservation

Trainees : Forester with more than 5 years expereince (25-30 trainees)

Period : 2.5 - 3 months

Contents : a. Basic skills on forest conservation
b. Plan and design of construction works for forest conservation
c. Construction skills for forest conservation

ii) Silviculture Course in the Middle Level Forestry Technicians Training Program

Objectives : To provide fundamental knowledge and techniques concerning silviculture

Trainees : Forester with more than 3 years experience (25-30 trainees)

Period : 2.5 - 3 months

Contents :
a. Planning of afforestation project
b. Techniques for systematization of nursery and plantation work
c. Techniques for designing and managing forest road
d. Techniques for application of machine power
e. Techniques for prevention of forest fire, diseases, insect and meteorological damages
f. Techniques of nursery and plantation works
g. Techniques of forest road construction
h. Operation and maintenance of machinery
i. Techniques of forest protection

iii) Equipment Operation Course

Objectives : To educate operators of heavy equipment for forest civil engineering

Trainees : High School graduate with 1 year experience (5 trainees)

Period : 1 month

Contents : a. Necessary knowledge to operate and maintain the equipment
b. Necessary skills to operate and maintain the equipment
c. Field practice

(2) Senior Course

i) Senior Course on Forest Conservation

Objectives : To provide high level knowledge and skills concerning forest conservation and to train personnel who can become training instructor

Trainees : Students who finished the ordinary course (5 trainees accepted)

Period : 8 months

Contents : a. More specialized knowledge and skills on forest conservation
b. Topic researches related to forest conservation and submission of thesis
c. Carrying out planning and design works

ii) General Senior Course

Objectives : To conduct training generally related to forestry operation and systematic management and to upgrade the quality of leaders in the field of forest management

Trainees : District Chiefs of Forest Offices of equivalent (20 trainees)

Period : 3 weeks

Contents : a. Specialized knowledge and skills on forest conservation
b. Methods of operation and management for business
c. Case studies

3. Development of Model Areas on Forest Conservation

On the devastated land in the Pantabangan area as a model, the center will transfer developed and improved forest conservation techniques to the counterparts and trainees.

(1) Design, construction and maintenance of erosion control facilities

The center will conduct trials in introduction of specific techniques to the Pantabangan area, and summarized results on the following:

i) Planting
Introduction of Several vegetations

ii) Simple Construction
Application of wire cylinder, wicker works, etc., or arrangement of research records

iii) Concrete facilities
Application of concrete facilities or arrangement of research records

(2) Mechanized construction of erosion-control facilites

The center will conduct study on the feasibility of base excavation, concrete facilities and others.

(3) Other necessary techniques for forest conservation

The center will strive to develop and improve forest conservation techniques on survey and mapping, cost analysis and others.

(4) Systematization of Applied Techniques

Based on development from the aforementioned trials and other results in the Pantabangan area, the center will prepare forest conservation manual.

IV IMPLEMENTATION/ACHIEVEMENTS AND EVALUATION

IV-I Activities

A. Sub-Project I: Afforestation Technical Cooperation Center

1. Development and improvement of techniques on afforestation

(1) Site Classification

In order to successfully reforest the denuded grasslands of the Pantabangan Project area, site classification was done with topography, vegetative cover and soil type as parameters. The main objective of this activity is to determine the suitable species for reforesting grasslands.

Field surveys and investigation conducted since 1980 resulted in the classification of the Project site into 13 site types.

The suitable species for each site type were suggested by investigating the survival and growth performance of the tree species presently planted in each type. However, due to the absence of some recommended species in some types, further investigation should be conducted where all recommended species shall be planted in all sites. However, should there be difficulty in procuring the recommended species, major species that were found to be performing well will be used.

(2) Nursery Techniques

In nursery practices, different nursery techniques from seed collection and handling to hauling seedlings for outplanting have almost been developed for major species such as Acacia auriculiformis, Acacia mangium, Pterocarpus indicus, Gmelina arborea, Swietenia macrophylla, Leucaena leucocephala, and Pinus kesiya. Through these studies, the suitable and effective methods for each species were found out and these methods have been already adapted and applied in nursery operations.

In order to investigate the effect of shade after transplanting and sowing, shade tests were conducted for some species. Results show that shading after transplanting is not necessary for Eucalyptus camaldulensis, Acacia auriculiformis, Acacia mangium, Pinus kesiya and Gmelina arborea, provided that the soil is always moist. Likewise, it was found out that for Acacia auriculiformis, shading is not needed after sowing.

Experiments on the feasibility of raising bare-root seedlings and stumps for Pterocarpus indicus, Gliricidia sepium, Eucalyptus camaldulensis and Leucaena leucocephala showed positive results.

Based on improvement and development of specific techniques, an annual calendar for nursery practices showing the operational flow of all processes was prepared for Acacia spp, Eucalyptus camaldulensis, Pinus spp, Casuarina equisetifolia, Vitex parviflora, Swietenia macrophylla, Pterocarpus indicus and Gmelina arborea and is presently used on the nursery as a guideline.

One of the important tasks of future reforestation works is to secure seeds of better genetic quality. In this connection, a two-hectare seed orchard of Pterocarpus indicus was established using clonal materials from plus trees selected in existing plantations (Ilocos Sur). In the process, the techniques of vegetative propagation of P. indicus was developed.

However, in the establishment of seed orchard, progeny and clone tests are very important. Therefore, these tests should be conducted in the future.

Furthermore, seeds collected from 18 plus trees of Acacia auriculiformis were sown, germinated and planted (806 seedlings) for seed production in the future.

(3) Planting Techniques

Various techniques on planting have been developed and improved. Since the introduction of mechanized cultivation for site preparation in 1981, the survival and initial growth of

planted trees have been improved to a great extent, and subsequently, plantation establishment has been greatly assured. Mechanized cultivation has greatly reduced weeding activities due to the suppression of undergrowth. Manual work for preparing planting hole has also been improved and devoted to plantation establishment in steep sites where mechanization is not applicable, together with fertilization, careful planting and other maintenance activities.

In the past years, plantation establishment and management activities were greatly improved as a result of various experiments on specific techniques like proper size of holes, seedling storage, direct sowing, spacing, stump planting, mixed-planting, weeding, fertilization, interplanting, etc.

However, with regards to the development of techniques for plantation establishment and management, several aspects and subjects should be investigated. Studies should be conducted on the effect of mixed-planting, types and levels of fertilization for each species, improvement of the survival rate of stump planting of Eucalyptus camaldulensis, spacing trials, and tending of different underplanted species.

(4) Techniques on Species Selection

In order to select the appropriate and suitable species for the reforestation of denuded grassland in the Pantabangan area, about thirty species have been planted at various sites of the area. Based on their early performance, twelve species appeared to be suitable for different sites in the area namely: Acacia auriculiformis, Anthocephalus chinesis, Casuarina equisetifolia, Eucalyptus camaldulensis, Gliricidia sepium, Gmelina arborea, Leucaena leucocephala, Pinus kesiya, Pterocarpus indicus, Swietenia macrophylla, Tectona grandis, and Vitex parviflora. However, growth performance of most species varies according to site conditions. P. indicus, S. macrophylla and Tectona grandis showed big growth variations in the different site types compared with A. auriculiformis and G. arborea which showed good growth in most of the site types. Likewise, L. leucocephala showed good growth only on "fiils" along forest roads and in slided soils.

Based on the aforementioned preliminary observations and results, there is an urgent need to expand species trial activities for the different site types. Furthermore, species trials for interplanting activities should be conducted as this will be the thrust in the future.

Provenance testing has been envisioned since the start of the project, but it was only in 1985 that the idea was realized with the use eucalypts and some other species. The trial should examined carefully for the coming years.

(5) Countermeasure against diseases and insects

Damages caused by major diseases were investigated and the guidelines for controlling these diseases, especially in the nurseries, were already prepared in the form of a manual during the early stage of the Project. However, it is now being revised based on new findings.

With regards to insect infestations, continuous investigation and monitoring are being done. Damages in the nursery are being controlled by using insecticides.

Insect infestations were first investigated in 1983. Another investigation was conducted this year and a manual is expected to be finalized. Nevertheless, pest and disease monitoring and control is a continuing activity.

(6) Techniques on Forest Fire Control

Recovery of trees damaged by fire is being investigated and monitored in order to select species to be planted in fire prone areas and for greenbelt. Results show that Gmelina arborea and Tectona grandis are the most promising species because they are fire resistant species and their rate of recovery after a grass fire is high.

Methods of firebreak construction i.e. brushing by manpower,

controlled burning, application of herbicide, and scraping by bulldozer were investigated with costs and recovery of grass as parameters. Results show that in large scale reforestation, scraping by bulldozer is the most appropriate method because accomplishment per unit time is high and the maintenance cost is greatly decreased thru time. Likewise, for small scale reforesta -tion, brushing by manpower is found out to be the most economical.

Furthermore, fire occurrence is continuously being monitored and analyzed in order to identify and devise preventive and control measures. In doing so, the dangerous zones and fire duration were identified.

However, fire occurrence can not be eliminated as all grass fires in the project are caused by human activities. Therefore, it is necessary to educate the people within and around the fringes of the Project. Extension works were being done annually thru the employment of extension workers (mostly barangay officials), conduct of educational seminar, and thru print media where signs and slogans were being posted in strategic places within the Project site and in public establishments.

Greenbelts were established using fire resistant species like Gliricidia sepium in some part. However, it takes years to see its contributory effect on fire prevention. It is therefore necessary to develop specific techniques to hasten the establishment of greenbelts like species trials, spacing trials, fertilization trials and also the use of herbicide to control fuel (biomass) production of grasses.

(7) Techniques on Forest Road Construction

Drainage work and slope rehabilitation/revegetation are very important aspects in forest road engineering. For drainage works, run-off productivity of precipitation was already computed as basic data in designing the scale of drainage canal.

On the other hand, the length of forest roads constructed since 1977 is about 140 kms. However, not all are being maintained

throughout the year. Repair and maintenance works are on priority basis depending on the frequency of use. Nevertheless, those works spread over long distance and especially repair of drainage canal needs huge manpower. Therefore, further improvement concentrated in mechanized work is still needed.

With respect to roadbank stabilization and rehabilitation, direct seeding and direct planting of cuttings of Gliricidia sepium in combination of other species showed good results.

(8) Systematization of Silviculture and Forest Protection

With the development of various specific techniques for plantation establishment and management, operational guidelines are now being prepared in the form of manuals. Guidelines for nursery practices, planting operation, forest road construction, and forest protection are expected to be completed within the cooperation term of the Project.

2. Progress/Implementation of Work

(1) Nursery

Since the start of the project, twenty nurseries including eight subsidiary nurseries have been established, but at present only two are existing (Table 2-1).

In those nurseries, nearly 13.1 millions of seedlings have been produced for ten years. The production by species and year is shown in Table 2-2. The top ten species by the order of seedling production are: Acacia auriculiformis, Gmelina arborea, Pterocarpus indicus, Pinus kesiya, Leucaena leucocephala, Pinus caribea var. hondurensis, Swietenia macrophylla, Pinus oocarpa, Tectona grandis, and Eucalyptus camaldulensis.

However, seedlings of some species (Leucaena leucocephala, Pinus caribea, and P. oocarpa) were raised only during the early years of the project while those of Acacia auriculiformis have been raised only lately. This has resulted mainly from species

selection, although the choice of some species may have decided on the basis of seed availability.

(2) Plantation

For the past ten years (1977 to 1986), about 7,900 ha. have been repoted is planted. Excluding replanting, the area planted covers about 6,200 ha. which means that nearly 80% of the target (8,100 ha.) was accomplished (Table 3-1).

i) Species planted

Gmelina arborea and Acacia auriculiformis are the top two species used for the plantations established since 1977 (Table 3-4). More than half of the plantations established during the last five years of the Project are occupied by those two species.

Pterocarpus indicus and Leucaena leucocephala are next to those two species. The former has kept nearly the same level of the area planted throughout the period, but the latter species has not been planted in the latter period of the project. Other species show different tendencies. It seems that such tendencies do not only depend on silvicultural reasons, but also on operationa reasons.

ii) Mechanized site preparation

The mechanized cultivation introduced in a large scale in 1981 was effective to both survival and early growth of the trees planted (Table 3-1). It can be applied to the slope up to 15 degrees if the cultivation is done along the contour.

iii) Weeding

The importance of weeding has been recognized since the early stage of the project and the area weeded has been increasing almost year after year (Table 4). However, in all cases the area weeded is less than the total area planted in the same year and that in the preceding year except 1983. Actually the experiences indicate that weeding should be done at least in the year of planting with most species and repeated in the following year in some cases.

In this connection, mechanized cultivation is very effective in retarding the regrowth of floor vegetation, which may favor the growth of planted trees.

(3) Forest Road Construction

To meet the large-scale re-afforestation planned, it was necessary to establish a forest road network. For ten years, ca. 140 km in total have been constructed, including a main forest road and a working forest road (Table 5). Through this construction, the following have been developed: how to determine the route; basic road structure, especially, drainages; rehabilitation of road embankment slopes; etc.

(4) Fire Protection

It is said that the success of re-afforestation in a tropical grassland with severe dry season depends on effective fire prevention. Irrespective of continued efforts since the start of the project, a part of plantations have been subjected to fire. Damaged area by year is shown in Table 8.

For the past nine years, the fire has occurred 77 times and the area burnt amounts to 1,453 ha. but most of Tectona grandis and Gmelina arborea trees have sprouted after fire. However, in areas where trees burned cannot recover the some have been replanted.

To prevent fire and also to protect plantations from fire, various countermeasures have been taken as follows: (i) organizing fire-preventing and fire-fighting crews, (ii) firefighting equipment/facilities, machines and tools (Fig.2), (iii) partionin g the plantations by the combinations of fire-breaks, green belts (including natural stands), forest road network, etc. (Table 7-1), (iv) integrated system for fire-prevention and fire-fighting, including fire engines (Table 7-2), and (v) education of rural people.

It seems that all of those countermeasures have been effective and minimized the fire damage to the plantations established, but still there have been the damages as shown in Table 8. The cause for some of the fires seems to have been an intentional fire.

To examine the fire break density to the total plantation area established, it is much lower in 1983 and 1984. This is mainly because the regrowth of floor vegetation was retarded effectively by mechanized cultivation and also because the survival and growth of Acacia auriculiformis and Gmelina arborea, major species in the later period of the project, have been generally good.

3. Countermeasure against forest fire

Since the establishment of the Project, fire prevention has been one of its most important activities. In order to protect the plantation from fire, various fire prevention and control programs and strategies have been designed and implemented. These programs are periodically revised and improved to suit to whatever the Project needs.

Major countermeasures established so far are as follows:

i) Organization of fire prevention and control group
ii) Preparation of equipment and tools
iii) Construction of firebreaks and greenbelts
iv) Installation of water tanks
v) Installation of communication system
vi) Construction of look-out towers
vii) Community cooperation

The fire prevention and control consists of four (4) groups and each group is composed of firefighters and firetruck equipped with radio system, stationed in each parcel and always prepared round the clock (attached figure). On the other hand, to detect fire at its early stage, a well-equipped detection system/watch system is organized consisting of three (3) permanent look-out towers, temporary look-out towers and patrol crews.

The plantation is almost partitioned by firebreaks, forest roads and natural forests, and thus fire damage is minimized even if fire has encroached already. On the other hand, since all fires are caused by men and their related activities, any countermeasure will not be effective without the cooperation of the local people. Therefore, various measures have been conducted to educate them, including poster contest for fire prevention, contribution of sporting goods to local people, pre-planting ceremonies and educational campaign thru the barangay officials. Also, the families living in the areas adjacent to identified fire zones were provided with mango seedlings this year (1986) to be planted in their respective areas.

However, despite of all these measures, fires occur every year resulting in extensive damages. Nevertheless, fire occurrence is decreasing so with the damage rate.

4. Implications of Afforestation

(1) Dissemination of the techniques

Various techniques developed are reviewed in the section above. Some of those techniques seem to have already been introduced directly or indirectly to adjacent reforestation projects, or even to other reforestation projects in the country.

For example, the disease manual mentioned above was issued by the project in the second year. This was appreciated by the then Project Director and distributed to all the reforestation projects of the Philippines. Similar examples are seen with some of the technical notes such as Nursery Techniques.

As to actual techniques, the importance of weeding was recognized much earlier and in some of adjacent projects weeding has been done often.

The importance of forest road network and mechanized site preparation is also recognized, although those may not be applica-ble to ordinary reforestation projects in the country at present. Various techniques developed in the project are of great signifi-cance in showing the way in which we can succeed in afforestation in such a devastated grassland. In other words, the technical possibility was proved for future re-afforestation.

(2) Environmental Implication of Afforestation

It is too early to discuss about the environmental effect of afforestation, but there are already some indications from this point of view.

Preferable changes have been expected in soil environment. Although actual figures have not been collected for physical and chemical changes, there are indications showing the improvement of those properties. Interesting results are obtained in the change of fauna in the soil. Composition and mass of soil fauna were increased especially in the stand of Acacia auriculiformis established in the grassland where Themeda triandra was dominating, although soil fauna in the site where Imperata cylindrica dominates is richer than in the site where Themeda dominates.

Further attention should be paid on the change of soil productivity and water holding capacity.

In the very early stage of the Project, it was intended that a study be made to determine the effect of afforestation on water stream flow and soil movement. Because of some difficulties in the field, unfortunately, neither the facilities were completed, nor the survey was carried out.

Micro-climates may possibly be affected by afforestation. So far, however, appreciable data have not been collected yet.

(3) Socio-economic Implication of Afforestation

Another important impact of the project is from a socio-economic aspect. The project has invited a short-term expert for this aspect twice, who is expected to contribute the detailed results to the final technical report. The outline of his surveys is as follows:

i) Contributions to local communities

a. Improved income of the poor class in the area

Nearly twenty percent of potential labor force have been employed by the project and about seven percent of total income in 1985 are from this project.

More people of the poor class are benefited by the project, under the so-called "rotation system".

b. Improved living conditions in the communities concerned

The unemployed are decreased and the living level of the local poor is improved . Those who move into the area for job are increasing.

Construction of forest roads, overflows, and small bridges, and some repairs of ordinary roads.

ii) Improved consciousness of local people on afforestation

iii) Increased direct interests to afforestation

It seems that some local people are interested in branches and pole-size trees if prunning and/or thinning are

done. Some of local people express their wish to include fuelwood species and/or fruit-tree species, which were included in the communal tree farming program.

The so-called "family approach" system was applied both in 1981 and 1982. It was successful at least in protecting the plantation from fire.

B. Sub-Project II: Training Center for Forest Conservation

1. Technical Training on Forest Conservation

(1) Generalities

All training programs conducted in the Training Center were based on the Basic Plan as to their contents, duration or schedule and the number of participants for each training course. The status of implementation of these training courses is shown in Table 9-1.

In the Basic Plan, only five (5) batches of the courses in the Middle Level Forestry Technicians Training Program were scheduled for implementation but six (6) batches were already carried out. The Japanese side, in this aspect, aided in the expenses for the implementation of Forest Conservation Course and Silviculture Course in the Program. The Equipment Operation Course was implemented once in 1985. The Senior Course on Forest Conservation was also implemented once in 1985. Lastly, the first batch of the General Senior Course was likewise implemented in 1985. Two (2) more batches of Senior Course will be scheduled for iplementation during the early part of 1987.

Since all regions in the Philippines were represented in the training courses especially in the Middle Level Forestry Techni - cians Training Program, it is expected that their learnings are actually applied to support forest conservation efforts. Furthermore, information dissemination and technology transfer not only to their peers.but also to the general public are also expected to be carried out by the graduates of the training.

Monitoring and Evaluation of Middle Level Training graduates are now being conducted to determine the effectiveness and viability of these training programs. The result of the activity is expected at the end of 1986.

As a result of these training programs, handouts and textbooks on erosion control, surveying and concrete works were prepared and distributed to training participants.

Before the completion of the Training Center, additional trainings were carried out by the Philippine side, using the facilities of the Training Center, from June 1980 to July 1982 as shown in Table 9-1 Remarks.

(2) Particulars

(2)-1 Ordinary Course

i) Forest Conservation Course in the Middle Level Forestry Technicians Training Program

This training has been carried out every year since 1982. The latest was the sixth batch finished last April 1986. The contents of the course are shown in Table 9-2.

This training put emphasis on the practice of planning, designing and actual construction of erosion control works by both structural and vegetative methods.

After lectures and classroom exercise are done as theoretical inputs, trainees are divided into four (4) groups for field works. Each group is assigned to a particular erosion problem area where they are required to prepare the plans and desings. These plans and designs are reviewed by a technical panel first before finally executing it in the field by the groups.

The sites used by the trainees for field practice in the past have been completely restored, which contributed in the rehabilitation needs of the Pantabangan Watershed.

As of November 1986, 141 foresters all throughout the Philippines have already graduated from this training and they are taking an active part as middle level technicians at present. In the whole, it is considered that this training has accomplished the set objectives.

ii) Silviculture Course in the Middle Level Forestry Technicians Training Program

This training have been conducted every year since 1982. The sixth batch was finished in September 1986. The contents of this course are shown in Table 9-2.

This training put emphasis on the practice of silviculture. After the theoretical inputs, the trainees are divided into four (4) groups for the purpose of field practice and each group is required to prepare a reforestation plan based on field data gathered. The plans are then presented before a technical panel for deliberation.

As of November 1986, 143 foresters have already graduated from this training and they are now taking an active part as middle level technicians in reforestation projects. As a result, it is considered that this training has accomplished the set objectives.

iii) Equipment Operation Course

This training was conducted once in 1985 under the title of Heavy Equipment Operation Course. In the process of implementing this trianing, the trainees made use of the heavy equipment of project. The graduates of this course are now taking an active part in operation and maintenance of equipment in reforestation projects utilizing heavy equipment.

(2)-2 Senior Course

i) Senior Course on Forest Conservation

This training was conducted once under the name of Trainer's Training on Forest Conservation in 1985.

Trainees of this training were selected from graduates of the Middle Level Forestry Technicians Training on Forest Conservation who excelled in the course.

This training including lectures, preparation of plan, field practice, topic researches and submission of the thesis had been carried out in a period of six (6) months. The trainees stayed in the field for a month during their research work for the submission of their individual thesis. However, construction of erosion control works was not carried out because of insufficient budget for this purpose.

The graduates of this training now serve as resource persons of the Center during trainings on forest conservation for Middle Level technicians.

ii) General Senior Course

This training was conducted once under the name of Senior Course on Forest Conservation in 1985. The course was designed for supervisory level positions like District Forester and Assistant District Foresters. The second and third batches intended for Visayas and Mindanao respectively are scheduled for implementation in 1987 to cover all regions in the Philippines.

Since the District Foresters cannot stay long away from their office, they spent one month formal training in the Center after which they were allowed to prepare their case studies in their respective regions. Their theses were submitted to the monitoring teams after two (2) months.

At present, the graduates of this training are active as district forester of respective offices.

2. Development and Improvement of Techniques on Forest Conservation

(1) Design, Construction and Maintenance of Erosion Control Facilties

(1)-1 Generalities

As of November 1986, a total of 52 spots for hillside works and 18 pots for stream works has been completed restoring several eroded areas within the Pantabangan Watershed since the start of the Project in 1977. Erosion control works were installed in areas near the Training Center in Parcel-I since 1982. However, there are several spots in Parcel-II and Parcel-III where erosion control works were done before the establishment of Sub-Project II. The details of these erosion control facilities are shown in Table 10.

The erosion control facilities include structural and vegetative methods. Hillside works by simple construction measures were tried for restoring small landslides within the afforestation area. Stream works were done by constructing small concrete dams and wet masonry revetments for the stabilization of eroded hillsides and riverbanks. Planting of erosion control tree species is conducted in these structures during the rainy season.

Sub-Project II started in implementing training programs in 1982. Since then, erosion control works were practiced by trainees of Middle Level Forest Conservation Training. The center served as the venue for the transfer of technology. These basic techniques have been disseminated to different parts of the country through the graduates. However, the development and improvement of erosion control techniques to fit in this area are still under way.

(1)-2 Particulars

i) Planting

Since 1982, seven (7) vegetative survey plots have been eatalished mainly to study the suitability of grasses and tree species for erosion control purposes. The survey is a continuing activity as a part of research study. Initial result of the survey and actual field observation proved that terracing works using cogon, talahib, and napier grass, and widelia cuttings are very good measures for erosion control. Likewise, kakawate cuttings and seedings, and planting Acacia auriculiformis seedlings are good measures.

Because of long dry season and shallow soil, it is very difficult for grasses and trees to grow in the area. It is still necessary to develop techniques of planting to fit in this area in the future.

ii) Simple Construction

Techniques on simple construction work are important for hillside and stream works in order to stabilize the eroded area from further erosion while preparing the site for planting. For this purpose, local materials available in the area are used to reduce over-all cost.

Structures like gabion filled with boulders, cogon mats using cogon grass, and wattling work using bamboo and alibangbang branches are made and often combined to form a complete structure for soil erosion control.

One innovation in the development of erosion control techniques is the discovery of the cogon band wattling and cogon mats as effective and economical materials for hillside works. The cogon band wattling is the combination of napier and cogon grasses tied together to form circular bands. These are installed together with wooden piles to form wattling. On the other hand, cogon mats are prepared with the use of abaca ropes and wooden tools. The mats are prepared in the same manner as used in making the popular Japanese straw mats. These materials are extensively used in the project's erosion control works because the techniques can be easily adapted to Philippine conditions.

This kind of simple work has been developed very recently. It is necessary, therefore, that the durability of these simple but effective measures in relation to specific purposes should be examined further.

iii) Concrete Construction

In this area, large scale concrete dams like those employed in Japan are very few. Except those in the Model Erosion Control facilities, most of the concrete works are small concrete construction like wet wall masonry and concrete check dams employed in stream or river banks and hillsides. In this situation, the techniques of concrete construction as erosion control measures are still considered in the the elementary stage.

Sub-Project II, the concrete testing laboratory was used for the research of concrete mixing designs and strength test and its application to concrete construction, where comparative analysis was done on the sand and gravel collected from Dig-dig and Carranglan Rivers. As a result of this experiment, a guide manual for concrete construction was prepared. However, the application of these techniques is still limited, and therefore it is necessary to transfer these techniques to the Philippine counterparts and trainees through the implementation of concrete work.

(2) Mechanized Construction of Erosion Control Facilities

The application of mechanized construction in erosion control works is very minimal. It is difficult, therefore, to study on mechanized construction. A comparative study was made between mechanized excavation by backhoe and excavation by manpower. Concrete Works using mixer was also analyzed for cost. Because of the lack of data, a manual of mechanized construction based on the techniques of Japanese mechanized construction was prepared instead.

The majority of erosion control works projected in the area will be hillside works to be done by manpower. However, study will be continued on mechanized construction in stream works for possible implementation.

(3) Other Necessary Techniques for Forest Conservation

Supportive techniques in surveying, mapping and cost analysis is very important in erosion control works.

Textbooks of compass, level and transit survey on erosion control works and forest road construction were prepared. These textbooks were utilized during training on forest conservation. Trainees have learned about surveying and mapping of erosion control works. Furthermore, actual techniques of erosion control and forest road construction were transferred to project counter -parts through field implementation.

Cost analysis of erosion control works accomplished by the project since 1982 can not be analyzed properly because data were not consistently collected and the working process was not systematic as expected. However, cost analysis of erosion control works done by the trainees of the forest conservation course has already been started. Presently, on-going erosion control works are properly documented in technical notes to include cost for every activity. With this, the project will be able to conduct an accurate cost analysis in the future.

Cost analysis is very important in designing erosion control works and estimating their cost. In this regard, collection of data in every activity in the course of implementing erosion control works has to be done properly and consistently.

(4) Systematization of Applied Techniques

Manuals of forest conservation will be made out based on the techniques developed and improved in this area and the techniques in Japan. The manuals will be finished by the end of the project term.

Main items in the manuals are as follows:

i) Basic survey on forest conservation
ii) Design and construction of hillside works
iii) Design and construction of stream works
iv) Concrete construction
v) Surveying by compass, level, etc.

(5) Others (Surveys)

Different surveys have been conducted in the area to gather basic information for the preparation of forest conservation plans. The surveys are shown in Table 10-2.

IV-II Inputs

1. Japanese Side

(1) Dispatch of Experts

As shown in Table 11 forty (40) long term experts have been dispatched satisfactorily in line with the R/D. No serious trouble has occurred by changes of the experts because a certain period for taking-over was set for each case with some unavoidable exceptions.

As for short-term experts in various fields, fifty five (55) persons have been dispatched so far as shown in Table 12 when necessities arose, and they well contributed to the smooth implementation of the project.

(2) Dispatch of Missions

The Japanese side has sent thirty three (33) missions to the Philippines in order to discuss and consult with agencies concerned and guide the Project for smooth implementation of the Project as shown in Table 13.

(3) Provision of Machinery and Equipment

The machinery/equipment and other materials have been sufficiently provided so far. By the end of the Japanese fiscal year 1985, the value of those amounted to Y 861 million as shown in Table 14-1 and major machinery and equipment listed in Table 14-2 show that they have been well managed and maintained to contribute to smooth implementation of the Project.

(4) Acceptance of Counterparts

As shown in Table 15, thirty one (31) Philippine counterparts have been accepted for technical training and/or observation on Japanese forestry so far.

This program brought a significantly worthwhile experience to all the personnel concerned with the Project because they could deepen their overall understanding of Japanese forestry and also acquire new and advanced techniques in their respective fields.

(5) Model Infrastructure Improvement Work and Others

In order to supplement a portion of the local cost expenditures, necessary measures such as assistance to model infrastructure improvement work, the emergency improvement work, middle level forestry technicians training program, etc, have been taken by the Japanese side as shown in Table 16, and have fostered the smooth promotion of the Project.

(6) Grant Aid

In accordance with the Exchange of Notes between the Governments of Philippines and Japan, in August 1978, and September 1984, the Japanese grant aid provided funds needed to construct the Training Center for Forest Conservation, and establish the Upgraded Forest Firefighting System, as shown in Table 17-1, and 17-2.

2. Philippine Side

(1) Land, Buildings and other Facilities

As shown in Table 18, the land, buildings, and other facilities have been provided timely and satisfactorily.

(2) Counterparts and other Personnel

As shown in Table 19-1 and 19-2, enough numbers of counterparts and other personnel have been assigned satisfactorily in line with the R/D, and each one has contributed to the successful implementation of the Project.

(3) Local Cost

Owing to the good understanding of the Philippine side, the local cost expenditures as shown in Table 20-1, 20-2 and 20-3 have been sufficiently provided and the technical cooperation activities of both the Sub-Project I and II have been carried out smoothly in general, although some delays on disbursement of the budget occurred.

(4) Others

As shown in Table 21, the Joint Committee Meetings including one Emergency Meeting have been held eighteen times so far in order to approve annual implementation plans and to solve various problems arising during the course of project implementation.

V CONCLUSIONS AND RECOMMENDATIONS

As a result of the evaluation conducted by the Joint Evaluation Team composed of the members from both the Philippines and Japanese sides from 28 November to 8 December 1986, the Team found out that almost all the objectives stipulated in the Record of Discussions have been substantially implemented with the exception of some matters to be further continued. This good performance is the fruit of the cooperative efforts by the Philippines and the Japanese personnel involved in the project. The conclusion of the Evaluation on each field of endeavor is as follows:

(1) Techniques on Afforestation

The reported area planted up to the time of evaluation has reached 6,200 ha. more or less which nearly 80% of the 8,100 ha. area of the project. The development and improvement of techniques on afforestation in grassland area have been almost completed through the establishment of both the trial and test plantations mainly with fast-growing species. Those techniques have been described in a series of technical notes and will be compiled in the Technical Report and several manuals that will be published later on. However, a follow-up is needed to verify the efficacy of those techniques and also for further development and trials combined with erosion control works, which may be done through the establishment of plantations in the remaining area.

Some parts of the plantations show reasonably good growth, but reportedly the life-span of fast-growing species is generally short, and so it is necessary to develop the techniques for changing the plantations of fast-growing species to useful long-rotation species. Such techniques have not been developed yet, although a few experiments have been started already. It is urgently needed to develop techniques related to species alteration.

(2) Techniques on Forest Conservation

The activities of the Training Center for Forest Conservation have been concentrated on the implementation of training courses for

the trainees of different levels from all over the country, which have been successfully carried out.

Erosion control works have been constructed mainly as training materials for trainees undergoing Training on Forest Conservation, and so those works have been located within the limited part of the project site. A series of those erosion control works such as as hillside works and stream works have been utilized not only for training but also for effective and smooth technology transfer.

The techniques for various works are being improved to be applicable to the Philippine conditions by way of using local and low-cost materials. However, the development and improvement of techniques on forest conservation are still inadequate and therefore, the transfer of related techniques to the Philippine counterparts have not yet been completed. This could be an important task to undertake in the coming years.

(3) Training

The goals of technical training indicated in the plan have been achieved successfully through the implementation of the existing projet, but the followings should be considered further in connection with the problems mentioned in the preceding part:

i) To incorporate the techniques on grassland rehabilitation established through the existing project, and

ii) To incorporate the techniques on plantation establishment combined with erosion control works, into the Course Design of future training courses.

(4) Social Forestry

Termination of the existing project should result in a serious decrease of the employment opportunities which have been provided to the rural poor in the area during the tenure of the project. Socio-economic surveys indicate that their income has been greatly improved, and in order to maintain their present standard of living they have to seek for some other sources of income apart from limited employment in the

project. Past experiences in the area indicate that the plantations established were cut for fuelwood, charcoal making, and some other uses. Forest plantations are also subjected to forest fires. These pressures will again be put to bear upon the RP-Japan established forest plantations.

For effective protection of the existing plantation and for future efficient re-afforestation, it is necessary to enlist the active participation of the rural people in those activities. Deep concern and strong interest of the people about re-afforestation must be fostered by all means. Further trials are needed to develop the system of plantation establishment and protection involving rural people.

In connection with the above conclusions, the Joint Evaluation Team agreed to recommend to both governments to establish a new project immediately after the termination of the existing one. The cooperation period of the new project should be more than five years and the contents of the fields covered should be as follows:

(1) Development and Improvement of techniques on species alteration, including tending and protection,

(2) Development and improvement of techniques on afforestation combined with erosion control works,

(3) Development and improvement of techniques on forest conservation applicable to the Philippine conditions,

(4) Technical training on afforestation, forest protection and forest conservation,

(5) Development of the system of plantation establishment and forest protection with deep involvement of rural people, and

(6) Establishment of the integrated watershed management system through the implementation of the above-mentioned items.

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Table 1. ACHIEVEMENTS IN DEVELOPMENT AND IMPROVEMENT OF TECHNIQUES ON AFFORESTATION

Items	Achievement	Achieve Rate	Remaining Subject
1. Site Classification	This is an attempt to classify the Project site by the variation of topography, vegetation and soil for implementing plantation establishment in this area. The site has been classified into 13 types. Suitable and adaptable species for each type are now chosen based on the growth results so far (May 1986) but supplemental trial is needed due to lack of planting species in some types.	75%	Supplemntary is needed to more appropriate species for each type.
2. Nursery Techniques			
1) Seed Test	Some methods for pre-sowing treatment were examined for major seven species as A. auriculiformis, A. mangium, P. indicus, G. arborea, S. macrophylla, L. leucocephala and P. kesiya, and the suitable & effective methods for each species were found out. Germination test was conducted under various storage term for A. auriculiformis amd G. arborea.	100%	
2) Shade Test	Investigation on effect of shade after transplanting and sowing was conducted. Result shows that shading after transplanting was proved not to be always necessary for A. auriculiformis, E. camaldulensis, A. mangium, P. kesiya and G. arborea, if transplants are given enough moisture. And also, shading after sowing was known not to be needed in particular for A. auriculiformis.	100%	
3) Nursery Practice Calendar	Based on the improvement and development on specific techniques, the annual calendar for nursery practice was	100%	

Items	Achievement	Achieve Rate	Remaining Subject
	prepared for major species like Acacia spp., E. camaldulensis, Pinus spp., Casuarina equisetifolia, Vitex parviflora, S. macrophylla, P. indicus and G. arborea.		
4) Establishment of Seed Orchard	Two hectares seed orchard for P. indicus has been planted with clonal materials of plus trees through selection of plus trees, development of techniques on vegetative propagation and so on.	100%	Progeny and clone tests are important subjects for the future.
5) Raising of Planting Stock by Cuttings	Raising of planting stock by cuttings was tried for P. indicus, G. arborea, Gliricidia sepium, S. macrophylla and Pileostigma malabaricum. Techniques for raising are established for P. indicus and G. sepium and a possibility to raise by cuttings was known for G. arborea. Another species were known to have difficulty.	100%	
3. Planting Techniques.			
1) Mechanized Cultivation	Based on the results of investigation on mechanized site preparation cultivation by bulldozer was proved to be more effective than manual work in terms of cost, survival rate and initial growth, and this method greatly reduced weeding due to the suppression of grasses.	100%	
2) Size of Planting Hole	Investigation on operation cost and growth under various sizes of planting holes was conducted for A. auriculiformis, G. arborea, and P. indicus. The results showed that two species (A. auriculiformis and G. arborea) had a tendency to increase their growth accordingly as the size of hole becomes bigger. However, con-	100%	

Items	Achievement	Achieve Rate	Remaining Subject
	sidering the operation cost, the present size (30 x 30 x 30 cm) seems to be reasonable in general.		
3) Seedling storage	Survival and growth after storage in corrugated cardboad box was investigated for stump seedlings of G. arborea and P. indicus. According to the result, it was considered to be able to store seedlings for almost one month.	100%	
4) Spacing Trial	Investigation on survival, growth, vegetation, etc. under various spacings is now undergoing for A. auriculiformis , G. arborea and P. indicus, but two species except P. indicus tend to promote their initial growth as the spacings become narrower.	75%	Narrow spacing is said to be unsuitable in dry land. Growth of stand should be considered to determine spacing for various species. From these points of view, further investigation is still needed.
5) Stump Planting	It was proved that the suitable size of stump for G. arborea was over 0.7 cm in basal diameter and 20-30 cm in stem length in survival, growth and competition with grasses. According to the results on stump planting trial of A. auriculiformis, S. macrophylla E. camaldulensis, L. leucocephala and P. indicus, it was known that 3 species except A. auriculiformis and S. macrophylla have possibilities for stump planting.	90%	Further improvement of techniques to get higher survival rate is still needed.
6) Mix Planting	This trial was conducted to investigate the effect of mix-planting under various mixing rates (25, 50, 75%) by legumious species (A. auriculiformis	75%	Further investigation is needed

Items	Achievement	Achieve Rate	Remaining Subject
	and P. indicus) and S. macrophylla. Since this trial has just started (1984), it is too early to get the results.		
7) Interplanting	In order to develop techniques on species alteration, P. indicus, S. macrophylla, dipterocarps and so on had been planted between rows and under trees, and investigation on the effect of growth under various light intensities is now undergoing. T. grandis was found to be unadaptable species for interplanting, but further investigation is still needed for the other species.	50%	In order to establish another plantation following after fast growing species, further studies are needed as follows : 1) Investigation on the growth under different condition of light intensity. 2) Development on appropriate techniques for interplanting.
8) Direct Sowing	Direct sowing was conducted for A. auriculiformis, S. macrophylla, G. arborea and L. leucocephala. S. macrophylla showed no germination. The other species showed almost good results in the mechanized cultivation sites. In the manual site preparation it is very doubtful if direct sowing has a merit due to necessity of weeding for 2-3 years.	100%	
9) Weeding	It has just established in 1986 and investigation is now undergoing.	50%	
10) Fertilization	Two methods were conducted for A. auriculiformis and G. arborea :	75%	Further trials are needed to

Items	Achievement	Achieve Rate	Remaining Subject
	fertilizer application at the time of planting and additional application at two years after planting. The results show as follows : 1) Mixture of organic and chemical fertilizer was more effective at the time of planting. 2) Chemical fertilizer was more effc-tive than organic fertilizer for additional application.		investigate the most effective composition and suitable amount of fertilizer applied for various species
4. Techniques on Selecting Species	Through trial plantation by nearly thirty species, twelve species seem to be hopeful at different site of the area so far. Planting species is chosen according to the said site classification, however, supplemental trial is needed to determine adaptable species for each type as mentioned above (1-4). Regarding species selection for interplanting, several experiments have just begun to select suitable and adaptable species for interplanting.	75%	Aside from supplemental trial plantation to determine adaptable species for site classification, several experiments are needed for selecting suitable and adaptable species for interplanting.
5. Countermeasure against Disease and Insect	Damages by major diseases and insects were investigated and the guidelines for controlling diseases especially in the nursery were manualized. However, the manual for diseases control is now being revised and also another manual for insects control is expected to be finished.	100%	
6. Techniques on Forest Fire Control			
1) Fire Resistant Species	Regrowth survey of trees damaged by fire was conducted for T. grandis, A. auriculiformis, G. arborea and P.	100%	

Items	Achievement	Achieve Rate	Remaining Subject
	indicus and the results are as follows 1) T. grandis and G. arborea recovered 100% 2) P. indicus recovered 59% 3) A. auriculiformis recovered 33%		
2) Firebreak	Regarding firebreak, construction cost and recovery of grasses after construction were investigated under various construction method : brushing by manpower, burnings, bulldozer works and application of herbicide. The results showed that, in the large scale afforestation, the method by bulldozer is more advantageous than by manpower and the method by manpower is adaptable to small scale afforestation.	100%	
3) Analysis on Fire Occurrences	According to the analysis on the results of the existing state of fire occurrence, it was clear that fire control measure should be established flexibly laying emphasis on more dangerous zone and more dangerous duration for fire and enforcement of patrol is important.	100%	It is necessary to study a drastic measure (ex. plantation establishment of local people and by peole) with direct and long-term interests to the local people.
7. Techniques on Forest Road Construction			
1) Probability Precipitation	Probability precipitation per hour which is necessary basic data for designing of drainage facilities, was computed based on rainfall records in the past.	100%	
2) Revegetation of Slope Face	Revegetation trial on especially dangerous banking face to erosion was conducted and the results showed that	100%	

Items	Achievement	Achieve Rate	Remaining Subject
	cuttings and direct sowing by G. sepium was useful in prevention of erosion and in practice.		
8. Systematization of Silviculture & Forest Protection	Based on the results on the development of individual techniques, these manuals are now in the process and they will be completed within the cooperation term of the Project.	75%	
1) Manual of Nursery Practices			
2) Manual of Planting			
3) Manual of Forest Road			
4) Manual of Insects & Diseases			

Table 2 - 1. TRANSITION OF NUMBER OF NURSERIES

YEAR	PARCEL I	PARCEL II-A	PARCEL II-B	PARCEL III	TOTAL
1977	1		1		2
1978	2		1	1	4
1979	4		5	1	10
1980	6	2	3	3	14
1981	7	4	3	3 (1)	17 (1)
1982	3	2	3	4	12
1983	5	2	3	4	14
1984	2	1	1	2	6
1985	1			1	2
1986	1			1	2

Remarks : The figures in Parentheses are for Family Approach.

Table 2 - 2. SEEDLING PRODUCTION

Unit : 1,000 Seedlings

No.	SPECIES	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	TOTAL
1.	Leucaena leucocephala	-	145.0	541.0	250.0	375.0	31.2	-	0.3	-	18.0	1,360.5
2.	Casuarina equisetifolia	-	47.0	2.0	-	50.0	12.2	6.2	2.2	0.2	-	119.8
3.	Gmelina arborea	-	19.0	233.0	666.6	667.0	269.9	202.4	119.7	253.0	89.8	2,520.4
4.	Eucalyptus spp.	-	35.0	21.0	83.4	117.0	82.1	0.5	2.1	5.3	10.9	357.3
5.	Pinus kesiya	52.0	225.0	755.0	175.0	200.0	20.0	0.2	-	0.2	11.0	1,438.4
6.	P. caribea	32.0	332.0	379.0	175.0	125.0	45.3	-	0.8	50.0	-	1,139.1
7.	P. oocarpa	30.0	163.0	268.0	150.0	75.0	-	-	-	-	-	686.0
8.	Pinus spp.	52.0	69.0	50.0	-	-	-	-	-	-	-	171.0
9.	Pterocarpus indicus	20.0	159.0	180.0	666.8	417.0	194.6	112.7	43.0	15.3	4.1	1,812.5
10.	Tectona grandis	10.0	33.0	17.0	222.2	156.0	4.0	0.1	-	-	1.7	444.4
11.	Swietenia macrophylla	10.0	341.0	133.0	125.0	83.0	0.9	3.6	4.7	3.3	8.4	712.9
12.	Acacia auricaliformis	-	-	-	83.4	83.0	524.0	76.7	410.7	260.7	553.1	1,991.6
13.	Vitex parviflora	-	-	-	-	17.0	3.8	-	2.5	0.8	2.7	26.8
14.	Others	-	18.0	25.0	125.0	-	3.5	6.3	20.5	41.8	62.8	302.9
	TOTAL	206.0	1,586.0	2,604.0	2,722.4	2,365.0	1,191.5	408.7	606.5	630.6	762.5	13,083.2

Remarks : The figures for 1986 are as of September 1986.

Table 3 - 1. ANNUAL PLANTED AREA

Unit : HA.

YEAR		1977		1978		1979		1980	
		Plan	Done	Plan	Done	Plan	Done	Plan	Done
New Planting	Uncultivation	200.00	210.00	600.00	731.30	1,170.00	1,028.50	1,000.00	883.40
	Cultivation								
	Sub-total	200.00	210.00	600.00	731.30	1,170.00	1,028.50	1,000.00	883.40
Replanting	Uncultivation				51.35	30.00	22.40	200.00	138.60
	Cultivation								
	Sub-total				51.35	30.00	22.40	200.00	138.60
TOTAL		200.00	210.00	600.00	782.65	1,200.00	1,050.90	1,200.00	1,022.00

YEAR		1981		1982		1983		1984	
		Plan	Done	Plan	Done	Plan	Done	Plan	Done
New Planting	Uncultivation	100.00	913.00	482.00	449.10	30.00	33.00	328.00	395.97
	Cultivation	1,000.00	200.00	118.00	122.50			142.00	84.49
	Sub-total	1,100.00	1,113.00	600.00	571.60	30.00	33.00	470.00	480.46
Replanting	Uncultivation	400.00	385.00	220.00	159.00	170.00	180.60	100.00	101.36
	Cultivation		80.00	155.00	134.50	150.00	153.20	30.00	48.45
	Sub-total	400.00	465.00	375.00	293.50	320.00	333.80	130.00	149.81
TOTAL		1,500.00	1,578.00	975.00	865.10	350.00	366.80	600.00	630.27

Unit : HA.

YEAR		1985		1986		TOTAL	
		Plan	Done	Plan	Done	Plan	Done
New Planting	Uncultivation	400.00	481.20	550.00	546.60	4,860.00	5,672.07
	Cultivation	150.00	115.00	50.00	30.40	1,460.00	552.39
	Sub-total	550.00	596.20	600.00	577.00	6,320.00	6,224.46
Replanting	Uncultivation	50.00	56.80	50.00	115.30	1,220.00	1,210.41
	Cultivation	50.00	50.00	50.00	11.70	435.00	477.85
	Sub-total	100.00	106.80	100.00	127.00	1,655.00	1,688.26
TOTAL		650.00	703.00	700.00	704.00	7,975.00	7,912.72

Remarks : 1986 Additional Plantation are as follows (excluding the above figures) :

1986 Additional Plantation

Unit : HA.

			Plan	Done
Additional 150 hectares (Cory Plantation)	New Planting	Uncultivation		56.88
		Cultivation		79.20
		Total	150.00	136.08
Commemorative Plantation for the International Year of the Forest	New Planting	Cultivation		32.00
		Total	30.00	32.00

Table 3 - 2. CULTIVATED AREA BY PARCEL

Unit : HA.

YEAR	PARCEL Ⅰ	PARCEL Ⅱ-A	PARCEL Ⅱ-B	PARCEL Ⅲ	TOTAL
1981	80.00	100.00	-	100.00	280.00
1982	124.00	65.10	53.00	14.90	257.00
1983	86.20	67.00	-	-	153.20
1984	47.00	48.25	37.69	-	132.94
1985	65.80	42.50	21.80	34.90	165.00
1986	11.70	9.30	11.00	10.10	42.10
TOTAL	414.70	332.15	123.49	159.90	1,030.24

Remarks : 1986 Additional Plantation are as follows (excluding the above figures) :

1986 Additional Plantation (Cory Plantation) - Cultivated Area 79.20 has.

Commemorative Plantation for the I. Y. of Forestry - Cultivated Area 32.00 has.

Table 3 - 3 - 1. PLANTED AREA BY PARCEL

(TOTAL)

Unit : HA.

PARCEL	TOTAL AREA	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	TOTAL
I	2,340	180.00	370.80	387.10	542.80	562.00	232.50	130.50	142.11	121.80	126.70	2,796.31
II-A	1,580	-	-	-	109.00	387.00 (160.00)	173.60	113.90	203.30	237.00	150.3	1,374.10
II-B	1,940	30.00	380.85	511.60	221.60	331.00	275.00	55.40	129.46	125.70	157.00	2,217.61
III	2,240	-	31.00	152.20	148.60	298.00 (140.00)	184.00 (50.00)	67.00	155.40	218.50	270.00	1,524.70
TOTAL	8,100	210.00	782.65	1,050.90	1,022.00	1,578.00	865.10	366.80	630.27	703.00	704.00	7,912.72

REMARKS : 1. The figures in parentheses are Family Approach.

2. 1986 Additional Plantation are as follows (excluding the above figures) :

1986 Additional Plantation (Cory Plantation) - 136.08 has. (New planting)
Commemorative Plantation for the I. Y. of Forestry - 32.00 has. (New planting)

Table 3 - 3 - 2. PLANTED AREA BY PARCEL
(NEW PLANTING)

Unit : HA.

PARCEL	TOTAL AREA	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	TOTAL	REMAINING AREA
I	2,340	180.00	349.45	380.70	462.50	269.00	123.50	-	-	22.80	-	1,787.95	552.05
II-A	1,580	-	-	-	109.00	383.00 (160.00)	173.60	-	202.40	229.20	150.00	1,247.20	332.80
II-B	1,940	30.00	350.85	495.60	189.60	207.00	90.50	-	128.06	125.70	157.00	1,774.31	165.69
III	2,240	-	31.00	152.20	122.30	254.00 (140.00)	184.00 (50.00)	33.00	150.00	218.50	270.00	1,415.00	825.00
TOTAL	8,100	210.00	731.30	1,028.50	883.40	1,113.00	571.60	33.00	480.46	596.20	577.00	6,224.46	1,875.54

Remarks : 1. The figures in parentheses are Family Approach.

2. 1986 Additional Plantation are as follows (excluding the above figures) :

1986 Addiotional Plantation (Cory Plantation) - 136.08 has.
Commemorative Plantation for the I. Y. of Forestry - 32.00 has.

Table 3 - 3 - 3. PLANTED AREA BY PARCEL
(REPLANTING)

Unit : HA.

	TOTAL AREA	1978	1979	1980	1981	1982	1983	1984	1985	1986	TOTAL
Ⅰ	2,340	21.35	6.40	80.30	293.00	109.00	130.50	142.11	99.00	126.70	1,008.36
Ⅱ-A	1,580	-	-	-	4.00	-	113.90	0.90	7.80	0.30	126.90
Ⅱ-B	1,940	30.00	16.00	32.00	124.00	184.50	55.40	1.40	-	-	443.30
Ⅲ	2,240	-	-	26.30	44.00	-	34.00	5.40	-	-	109.70
TOTAL	8,100	51.35	22.40	138.60	465.00	293.50	333.80	149.81	106.80	127.00	1,688.26

Table 3 - 4. PLANTED AREA BY SPECIES

Unit : HA.

SPECIES	1977	1978	1979	1980	1981	1982
1. Benguet Pine	13.62	71.42	202.50	54.40	-	5.00
2. Caribae Pine	10.84	129.64	66.70	134.55	-	-
3. Oocarpa Pine	8.50	63.60	117.30	50.90	-	-
4. Slash Pine	5.38	13.50	-	-	-	-
5. G. Ipil-ipil	39.07	148.60	85.86	224.25	258.15	-
6. Teak	37.04	44.90	107.00	23.75	-	-
7. Acacia (Samanea saman)	26.86	18.30	-	-	-	-
8. Acacia auriculiformis	-	1.00	-	61.95	249.20	413.60
9. Acacia mangium	-	-	-	-	-	-
10. Yemane	3.80	22.42	144.70	220.60	378.15	149.10
11. Agoho	16.00	14.70	-	-	52.93	8.60
12. Narra	12.96	100.72	173.30	185.30	69.55	148.65
13. Mahogany	14.41	113.52	123.40	36.75	43.94	8.50
14. E. Torelliana	2.42	5.20	-	-	-	10.40
15. E. Tereticornis	-	5.94	-	-	-	-
16. E. Camaldulensis	-	3.76	6.40	-	11.00	4.60
17. Camphor	-	0.66	-	-	-	-
18. Cashew	-	-	6.60	-	-	2.00
19. Mango	-	2.38	-	7.50	-	3.00
20. Kakawate	-	-	-	9.90	-	4.50
21. L. Ipil-ipil	8.14	5.32	-	-	-	-
22. Langosig	-	-	-	-	-	1.30
23. Molave	-	-	-	-	-	1.00
24. Others	10.96	17.07	17.14	12.15	515.08	104.85
TOTAL	210.00	782.65	1,050.90	1,022.00	1,578.00	865.10

Unit : HA.

SPECIES	1983	1984	1985	1986	TOTAL
1. Benguet Pine	0.20	28.50	54.10	11.00	440.74
2. Caribae Pine	-	0.70	1.20	-	343.63
3. Oocarpa Pine	-	-	0.64	-	240.94
4. Slash Pine	-	-	-	-	18.88
5. G. Ipil-ipil	-	0.21	0.20	2.00	758.34
6. Teak	0.10	0.27	0.10	0.5	213.66
7. Acacia (Samanea saman)	-	-	-	-	45.16
8. Acacia auriculiformis	85.50	381.81	292.10	489.20	1,974.36
9. Acacia mangium	2.70	20.07	43.15	80.40	146.32
10. Yemane	173.90	121.62	281.30	90.90	1,586.49
11. Agoho	1.10	0.80	-	-	94.13
12. Narra	95.10	62.56	15.90	4.30	868.34
13. Mahogany	3.70	4.26	5.15	10.60	364.23
14. E. Torelliana	1.00	-	-	-	19.02
15. E. Tereticornis	-	-	1.10	-	7.04
16. E. Camaldulensis	-	0.42	4.00	2.20	32.38
17. Camphor	-	-	-	-	0.66
18. Cashew	0.70	-	-	-	9.30
19. Mango	2.70	0.70	-	5.00	21.28
20. Kakawate	-	4.90	-	-	19.30
21. L. Ipil-ipil	-	-	-	-	13.46
22. Langosig	-	-	-	-	1.30
23. Molave	-	2.38	1.50	3.30	8.18
24. Others	0.10	1.07	2.56	4.60	685.58
TOTAL	366.80	630.27	703.00	704.00	7,912.72

PLANTED AREA BY SPECIES

Remarks : 1. Including New Planting and Replanting

2. 1986 Additional Plantation are as follows (excluding the above figures) :

1986 Additional Plantation (Cory Plantation)

SPECIES	1986
1. Teak	4.00
2. A. auriculiformis	111.00
3. A. mangium	0.40
4. Yemane	4.00
5. Narra	0.90
6. Mahogany	0.20
7. Mango	5.30
8. Others	10.28
TOTAL	136.08

Commemorative Plantation for the I. Y. of the Forest

SPECIES	1986
1. A. auriculiformis	20.00
2. E. camaldulensis	6.00
3. Others	6.00
TOTAL	32.00

Table 3 - 5. FAMILY APPROACH

Year	Block	Area	Species	Area	No. of Participants	Remarks
		HA.		HA.		
1981	90	160.00			54	
			A. auriculiformis	30.00		
			Yemane	55.00		
			Narra	55.00		
			G. Ipil-ipil	20.00		
			Sub total	160.00		
1981	101	60.00			36	
	102	80.00				
			A. auriculiformis	30.00		
			Yemane	45.00		
			Narra	45.00		
			G. Ipil-ipil	20.00		
			Sub total	140.00		
1982	103	50.00	A. auriculiformis	50.00	28	
TOTAL		350.00		350.00	118	

Table 4. ANNUAL AREA OF WEEDING

Unit : HA.

YEAR	1977	1978	1979	1980	1981	1982	1983
AREA	86.00	96.90	604.00	796.25	1,557.00	1,120.00	850.30

YEAR	1984	1985	1986	TOTAL
AREA	222.30	500.00	150.00	5,882.75

Remarks : Accomplishment for 1986 is as of September 1986.

Table 5. FOREST ROAD CONSTRUCTION AND REPAIR & MAINTENANCE

Unit : Km

YEAR	1977		1978		1979		1980		1981		1982		1983	
	Plan	Done	Plan	Done	Plan	Done	Plan	Done	Plan	Done	Plan	Done	Plan	Done
Forest Road Construction	4.0	4.0	20.0	26.6	30.0	23.8	20.0	19.7	20.0	24.3	20.0	20.1	-	-
Repair and Maintenance	-	4.0	4.0	23.1	30.0	44.2	43.0	61.8	50.0	83.6	113.8	119.0	56.0	53.0

YEAR	1984		1985		1986		TOTAL	
	Plan	Done	Plan	Done	Plan	Done	Plan	Done
Forest Road Construction	6.0	6.0	6.0	6.0	7.0	7.0	133.0	137.5
Repair and Maintenance	12.0	12.0	12.0	12.0	75.0	58.5	395.8	471.2

Remarks : Accomplishment for 1986 is as of September 1986.

Table 6. GROWTH OF THE PLANTED TREES

SPECIES	Planted Date	Age in Years and Month		Diameter (root collar)	Height	Remarks
		Year	/ Month	cm.	m.	
Pinus kesiya	Aug. 1977	9	9	11.39	4.96	Permanent spot
Pinus caribea	Aug. 1977	9	9	12.80	4.32	〃
Leucaena leucocephala	Aug. 1977	9	9	11.39	7.66	〃
	Aug. 1981	5	9	2.91	2.10	Site classification
Gmelina arborea	Aug. 1978	8	9	11.18	4.33	Permanent spot
	Aug. 1981	5	9	10.83	4.48	〃
	Aug. 1981	5	9	5.17	1.54	〃
Eucalyptus camaldulensis	Aug. 1977	9	9	8.99	4.89	〃
E. torelliana	Aug. 1983	3	9	4.08	1.75	Species Trial
E. tereticornis	Aug. 1977	9	9	7.90	4.27	Permanent spot
E. citriodora	Aug. 1983	3	9	4.26	3.92	Site classification
A. auriculiformis	Aug. 1981	5	9	8.83	4.00	〃
	Aug. 1980	6	5	* 7.73	7.72	* Diameter breast height
Tectona grandis	Aug. 1977	9	9	8.49	2.72	Permanent spot
Pterocarpus indicus	Aug. 1977	9	9	5.60	2.01	〃
Swietenia macrophylla	Aug. 1981	5	9	2.90	1.12	Site classification
Casuarina	Aug. 1977	9	9	8.35	4.76	Permanent spot

Table 7 - 1. CONSTRUCTION OF FIRE PROTECTION BELT

Unit : Km

YEAR	1978		1979		1980		1981		1982		1983	
	Plan	Done	Plan	Done	Plan	Done	Plan	Done	Plan	Done	Plan	Done
Fire Protection Belt (by Manpower)	16.0	2.0	54.0	120.0	120.0	135.0	200.0	206.0	194.0	195.0	55.0	53.0
Fire Protection Belt (by Bulldozer)												
Green Belt												0.5
TOTAL	16.0	2.0	54.0	120.0	120.0	135.0	200.0	206.0	194.0	195.0	55.0	53.5

YEAR	1984		1985		1986		TOTAL	
	Plan	Done	Plan	Done	Plan	Done	Plan	Done
Fire Protection Belt (by Manpower)		24.0		1.5		1.5		738.0
Fire Protection Belt (by Bulldozer)		45.6		367.0		93.5		506.1
Green Belt		4.4						4.9
TOTAL	47.0	74.0	400.0	368.5	400.0	95.0	1,486.0	1,249.0

Remarks : 1. Extention of Fire Protection Belt (by Bulldozer) before 1982 is indistinct.

2. Accomplishment for 1986 is as of September 1986.

Table 7 - 2. FIRE CONTROL ORGANIZATIONAL CHART

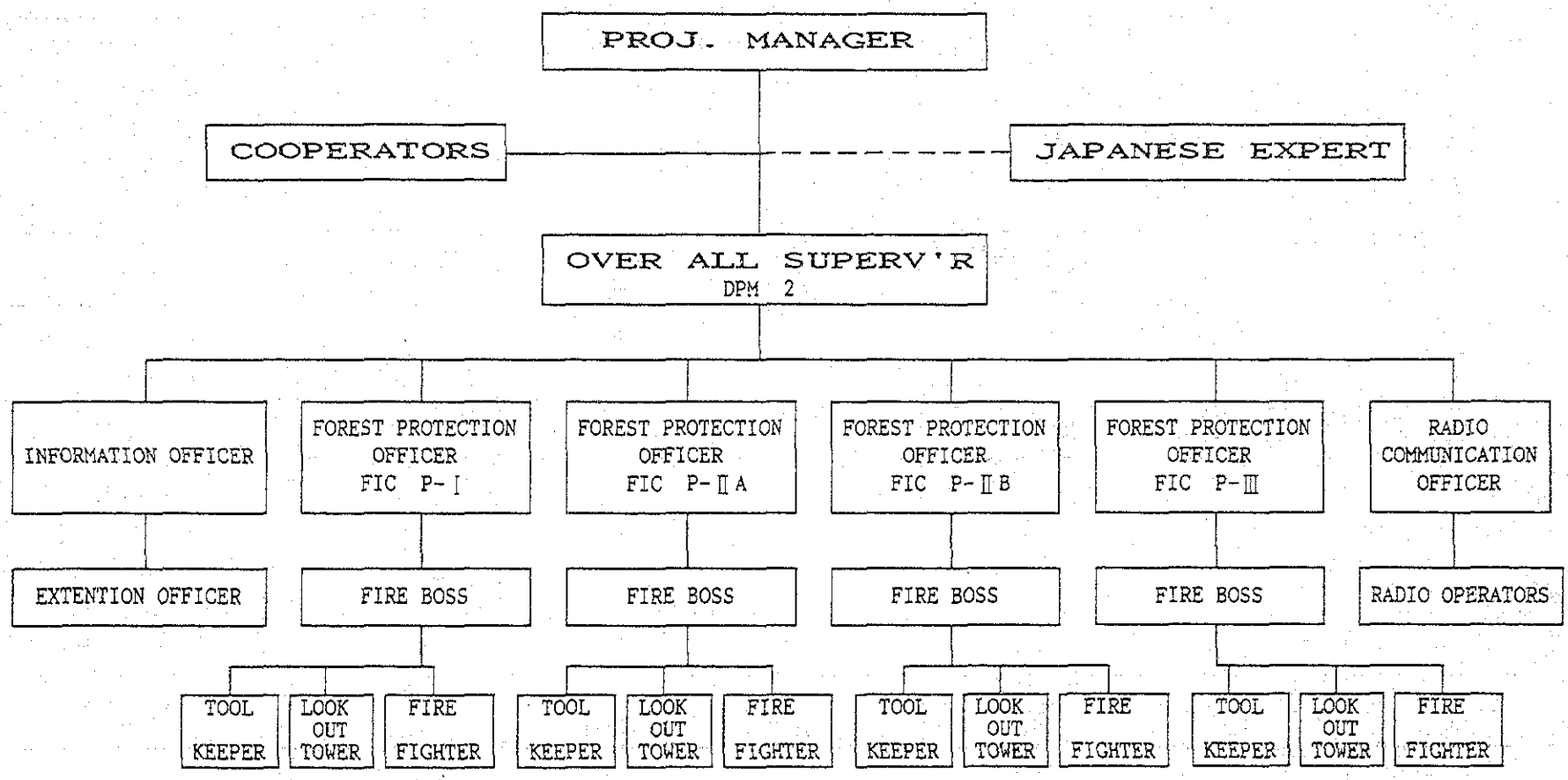

Table 8. FIRE OCCURRENCE

Unit : HA.

YEAR	TOTAL		PARCEL Ⅰ		PARCEL Ⅱ-A		PARCEL Ⅱ-B		PARECEL Ⅲ	
	Occu.	Burned Area	Occu.	Burned Area	Occu.	Burned Area	Occu.	Burned Area	Occu.	Burned Area
1978	1	30.00					1	30.00		
1979	4	16.00	4	16.00						
1980	6	288.00	2	13.00			4	275.00		
1981	8	94.00	2	25.00	1	22.00	4	43.00	1	4.00
1982	2	65.00					2	65.00		
1983	19	726.00	4	480.00	6	21.00	8	206.00	1	19.00
1984	4	103.00	1	3.00	1	60.00	1	20.00	1	20.00
1985	16	65.00	9	19.00	1	1.00	3	37.00	3	8.00
1986	17	66.00	4	25.10	5	17.50	5	3.00	3	20.40
TOTAL	77	1,453.00	26	581.10	14	121.50	28	679.00	9	71.40

Remarks : 1. Fire occurrence inside plantation area only

2. The figures for 1986 are as of September 1986.

Table 9 - 1. IMPLEMENTATION IN TECHNICAL TRAINING ON FOREST CONSERVATION

TRAINING COURSE	NO.	DURATION	NO. OF PARTICIPANTS
Ⅰ. Ordinary Course :			
i) Forest Conservation Course in the Middle Level Forestry Technicians Training Program	1.	1982.10. 1～11.30	24
	2.	1983. 5.17～ 7.28	24
	3.	1984. 2. 1～ 3.30	24
	4.	1984.10.15～12.13	22
	5.	1985.10.14～12.12	22
	6.	1986. 2.10～ 4.17	25
Sub total			141
ii) Silviculture Course in the Middle Level Forestry Technicians Training Program	1.	1982. 5.24～ 8.11	23
	2.	1983. 2. 2～ 3.31	25
	3.	1983.10. 3～12. 1	25
	4.	1984. 7.16～ 9.20	23
	5.	1985. 7.29～10. 3	23
	6.	1986. 7.14～ 9.24	24
Sub total			143
iii) Heavy Equipment Operation Course		1985. 3. 4～ 3.29	5
Ⅱ. Senior Course :			
i) Senior Course on Forest Conservation		1985. 1.24～ 7.10	4
ii) General Senior Course		1985. 6.10～ 7.10	21
TOTAL			374

Remarks : Before the amendment of R/D (July 1982), utilizing the Training Center, the activities planned originally were implemented as follows :

Training	Duration	No. of Days	No. of Participants
1. Soil Erosion Control	Nov. ～ Dec. 1980	30	35
2. Forest Occupancy Management Seminar	June, 1981	30	37
3. Security Seminar	Aug. 1981	1	200
4. District Planning Officer's Seminar/Workshop	1981	3	105
5. Soil Erosion Control	Nov. ～ Dec. 1981	45	36

Table 9 - 2. CONTENTS OF THE MIDDLE LEVEL FORESTRY TECHNICIANS TRAINING

1. FOREST CONSERVATION COURSE

Unit : DAY

SUBJECT \ BATCH • YEAR	1 1982	2 1983	3 1984	4 1984	5 1985	6 1986
GENERAL EDUCATION						
ORGANIZATION OF THE BFD	0.25					
BFD TARGETS IN THE 1980'S	0.25					
BUDGETING AND ACCOUNTING	0.5	0.25	0.5			
PERSONAL MANAGEMENT	1.0	2.0	2.0	2.0	2.0	2.0
INTEGRATED SOCIAL FORESTRY		0.5	0.5	0.5	0.5	0.5
THE PRESENT PROGRAM THRUSTS OF THE BFD ON EROSION CONTROL			0.5	0.5	0.5	0.5
TOWARD A MORE RESPONSIVE GOVERNMENT PEOPLE INTERCOURSE			1.0	1.5	1.5	1.5
ECONOMIC ANALYSIS VS. FINANCIAL ANALYSIS						1.0
SUB TOTAL	2.0	2.75	4.5	4.5	4.5	5.5
SPECIAL EDUCATION						
METEOROLOGY	1.0	1.0	1.0	1.0	1.0	1.0
FOREST HYDROLOGY	1.0	1.0	1.0	1.0	1.0	1.0
MATHEMATICS AND STRUCTURAL MECHANICS	3.0	3.0				
GEOLOGY AND TOPOGRAPHY	1.0	1.0	1.0	1.0	1.0	1.0
HYDRAULICS AND SOIL MECHANICS	3.0	3.0	2.0	2.0	2.0	2.0
OPERATION AND MAINTENANCE OF EQUIPMENT	1.0	1.0				
FOREST ECOLOGY		1.0	1.0	1.0	1.0	1.0
WATERSHED CHARACTERIZATION AND ENVIRONMENT MONITORING			2.0	2.0	2.0	2.0
SURVEYING	5.0	4.0	3.0	3.0	3.0	3.0
CONCRETE WORK	2.0	2.0	2.0	2.0	2.0	2.0
HILLSIDE WORK	3.0	2.0	2.0	2.0	2.0	2.0
STREAM WORK	4.0	4.0	2.0	2.0	2.0	2.0
SILVICULTURAL METHODS FOR SOIL EROSION CONTROL	3.0	3.0	3.0	3.0	3.0	3.0
FOREST ROAD	9.0	9.0	2.0	2.0	2.0	2.0
DENDROLOGY						1.0
GABION						1.0
PLANTING TECHNIQUES FOR OPEN AND DENUDED AREAS						1.0
FIELD TRIP	4.0	7.0	10.0	4.0	4.0	5.0
ACTUAL PLANNING, DESIGNING AND CONSTRUCTION OF EROSION CONTROL WORK AND FOREST ROAD IN THE FIELD (INCLUDING PLAN REVIEW AND EVALUATION)	6.0	16.0	15.0	19.0	19.0	22.0
SUB TOTAL	46.0	58.0	47.0	45.0	45.0	52.0
TOTAL	48.0	60.75	51.5	49.5	49.5	57.5

2. SILVICULTURE COURSE

Unit : DAY

SUBJECT \ BATCH · YEAR	1 1982	2 1983	3 1983	4 1984	5 1985	6 1986
GENERAL EDUCATION						
ORGANIZATION OF THE BFD	0.5					
BUDGETING AND ACCOUNTING	0.5		0.5	0.5	0.5	0.5
FOREST CONSERVATION EDUCATION	2.0					
BFD TARGETS IN THE 1980'S	0.5					
PERSONAL MANAGEMENT		1.0	2.0	2.0	2.0	1.0
TOWARD A MORE RESPONSIVE GOVERNMENT PEOPLE INTERCOURSE				1.0	1.0	
ECONOMIC ANALYSIS VS. FINANCIAL ANALYSIS				1.0	1.0	
MANAGEMENT BY FILIPPINO VALUES						1.0
THE PRESENT PROGRAM THRUSTS OF THE BFD ON REFORESTATION AND AFFORESTATION						0.5
SUB TOTAL	3.5	1.0	2.5	4.5	4.5	3.0
SPECIAL EDUCATION						
FOREST FIRE	2.0	2.0	1.0	2.0	2.0	2.0
PLANNING AND SITE CLASSIFICATION	4.0	4.0	3.0	3.0	3.0	
FOREST ROAD	1.0	2.0	2.0	2.0	2.0	3.0
AGROFORESTRY	2.0					
FOREST ECOLOGY	1.0	0.5	1.0	1.0	1.0	1.0
FOREST POLICIES, LAWS, DECREES RULES AND REGULATIONS	1.0					
FOREST SOILS AND IMPORTANT UNFERTILE FOREST SOIL	8.0					
SURVEYING	5.0	3.0	2.0	2.0	2.0	0.5
SOCIAL FORESTRY (INTEGRATED SOCIAL FORESTRY)	1.0	0.25	0.5	0.5	0.5	0.5
FOREST PATHOLOGY	2.0	2.0	1.0	2.0	2.0	1.0
NURSERY (MANAGEMENT, PRODUCTION, MAINTENANCE)	5.0	1.0	0.5	1.0	1.0	4.0
SEED TECHNOLOGY AND BLEEDING	4.0	1.0				
SILVICULTURAL METHOD	3.0	1.0				
PLANTING PRACTICE IN RP-JAPAN	4.0					
SOIL EROSION CONTROL		1.0	1.0			
FOREST SOIL AND GEOLOGY		3.0	3.0	3.0	3.0	3.0
RESEARCH TRENDS IN NURSERIES AND PLANTATION		1.0	1.0	1.0	1.0	
ROLE OF MICROORGANISHES IN ENHANCING GROWTH OF REFORESTATION SPECIES			1.0	1.0	1.0	1.0
PLANTATION MAINTENANCE (MANAGEMENT)			0.5	1.0	1.0	
SITE CLASSIFICATION IN THE PANTABANGAN AREA			0.5	0.5	0.5	
SILVICULTURE IN JAPAN			0.5	0.5	0.5	0.5
WATERSHED MANAGEMENT WITH EMPHASIS ON MONITORING OF METEOROLOGICAL FACTOR			1.0			

Unit : DAY

SUBJECT \ BATCH · YEAR	1 1982	2 1983	3 1983	4 1984	5 1985	6 1986
DENDROLOGY			1.0			
TREE STAND IMPROVEMENT		2.0	1.0			
FOREST TREE BREEDING AND SEED HANDING				2.0	2.0	
WATERSHED CHARACTERIZATION AND ENVIRONMENTAL MONITORING				2.0	2.0	
MECHANICAL CULTIVATION IN PLANTATION			0.5	0.5	0.5	
WATERSHED MANAGEMENT						3.0
TREE IMPROVEMENT						2.0
PLANTATION ESTABLISHMENT AND MAINTENANCE						2.0
ECONOMIC ASPECTS OF REFORESTATION						3.0
FIELD TRIP	4.0	1.0	1.0	3.0	3.0	
PREPARATION OF REFORESTATION PLAN	9.0	16.0	19.0	16.0	16.0	16.0
STUDY TRIP TO UP LOS BAÑOS, ETC. (INCLUDING PRESENTATION)	6.0	6.0	9.0	6.0	7.0	10.0
PRESENTATION OF PLAN						2.0
FINALIZATION OF PLAN				4.0	4.0	6.0
SUB TOTAL	62.0	46.75	51.0	54.0	55.0	60.5
TOTAL	65.5	47.75	53.5	58.5	59.5	63.5

Table 9 - 3. CONTENTS OF OTHER TRAININGS

1. HEAVY EQUIPMENT OPERATION COURSE (Feb. 20 - March 16, 1985)

SUBJECT	DAY
BFD AT THE 80'S	0.25
ORGANIZATION AND STRUCTURE OF BFD	0.25
HUMAN RELATIONS AND COMMUNICATION	0.5
ETHICS AND CONDUCT	0.5
SAFETY RULES	0.5
PLAN/RECORDS AND REPORT PREPARATION	1.0
TYPES OF VEHICLES AND EQUIPMENT	0.5
PARTS OF EQUIPMENT AND VEHICLE	0.5
HEAVY EQUIPMENT AND VEHICLE OPERATION	1.0
MAINTENANCE OF TOOLS, VEHICLES AND EQUIPMENT	2.0
CLASSROON EXERCISE AND MAINTENANCE OF HEAVY EQUIPMENT, LIGHT VEHICLES AND TOOLS	1.0
FOREST ROAD CONSTRUCTION	1.0
FOREST ROAD	1.0
FIELD EXERCISE	4.0
REPORT PREPARATION	2.0
TOTAL	16.0

2. SENIOR COURSE ON FOREST CONSERVATION (Jan. 24 - July 10, 1985)

SUBJECT	DAY
THEORIES OF TEACHING	0.5
COMPONENT SKILLS OF TEACHING AND THEIR APPLICATION	2.0
METHODS OF TEACHING/TRAINING	1.0
EFFECTIVE STRUCTURE OF LESSON/INSTRUCTION	1.0
MANAGEMENT OF A TEACHING SITUATION	1.0
DEVELOPMENT OF TEACHING AIDS	1.0
EROSION PROCESSES AND CONTROL	3.0
FOREST ROAD CONSTRUCTION	4.0
SILVICULTURAL METHODS FOR EROSION CONTROL	3.0
MAJOR FIELD ASSIGNMENT	0.5
BRIEFING ABOUT THEIR FIELD PRACTICUM	0.5
REPORT WRIGHTING	4.0
ADVANCED SURVEYING	5.0
CONCRETE WORKS	3.0

SUBJECT	DAY
HILLSIDE WORKS	3.0
STREAM WORKS	3.0
REVIEW OF THE TOPICS CARRIED-OUT FOR THE LAST 32 DAYS	1.0
FIELD EXPOSURE	25.0
FINALIZATION OF THE CASE STUDY	5.0
INDIVIDUAL PRESENTATION OF CASE STUDY	3.0
REVISION/INCORPORATION OF CORRECTED ITEMS	5.0
REVIEW OF WORKS CARRIED-OUT FOR THE SECOND MONTH	1.0
CARRANGLAN FOREST MANAGEMENT UNIT	2.0
FIELD EXAM	2.0
TEACHING PLAN DEVELOPMENT	6.0
REVIEW OF TEACHING PLAN OUTLINE	1.0
RESEARCH WORK (in U.P. Los Baños)	17.0
TEACHING GUIDE MANUAL PREPARATION (U.P.L.B.)	10.0
TEACHING DEMONSTRATION (-do-)	2.0
TEACHING GUIDE MANUAL REVISION	6.0
CONSTRUCTION OF SOIL EROSION WORKS	14.0
FIELD PRESENTATION	1.0
IDENTIFICATION OF LEARNING LABORATORY	8.0
REVIEW OF WORKS CARRIED-OUT	1.0
WRAP-UP SESSION AND COURSE EVALUATION	1.0
TOTAL	146.5

3. GENERAL SENIOR COURSE (June 10 - July 10, 1985)

SUBJECT	DAY
BFD AT PRESENT	1.0
ACCOUNTING AND BUDGETING	0.5
AUDITING	0.5
TOWARDS A MORE RESPONSIVE GOVERNMENT PEOPLE INTERCOURSE	1.0
PERSONNEL MANAGEMENT	1.0
FORESTRY PLANNING	3.0
INTEGRATED SOCIAL FORESTRY	0.5
WATERSHED MANAGEMENT	0.5
TIMBER MANAGEMENT	1.0
RANGE, PARKS AND WILDLIFE MANAGEMENT	1.0
REFORESTATION	0.5
FOREST PROTECTION	0.5
ENGINEERING AND INFRASTRUCTURE	0.5
STUDY TRIP	8.0
PLAN PREPARATION	4.0
MAKING-OUT FORESTRY PLAN (in the participants respective district offices)	30.0
TOTAL	53.5

Table 10 - 1. ACTIVITIES OF EROSION CONTROL WORKS

(AS OF SEPTEMBER 1986)

YEAR	PARCEL	NO.	WORK	AREA/VOLUME	KIND OF WORK	FOR MATERIAL USE
1977	CTP	1	Hillside Work	0.1 has.	Grading	
					Simple Terracing	Vegetation Bag (Samon, Cogon)
					Sodding	Sod
					Simple Terracing	Samon, Cogon Talahib
			Stream Work	75 m²	Revetment	Wet Masonry
1978	CTP	1	Repair Work			
			Stream Work	34 m²	Revetment	Wet Masonry
			Hillside Work	45 m	Water Channel	Dry Masonry
				30 m	Closed Conduit	Stone
					Simple Terracing	Vegetation Bag
	I	2	Hillside Work	0.175 has. (7)	Grading	
					Simple Terracing	Samon, Cogon
		3	Hillside Work	0.75 has. (12)	Grading	
					Simple Terracing	Vegetation Bag, Stamp
		4	Hillside Work	0.55 has.	Grading	
					Simple Terracing	Stamp
					Planting	Giant Ipil-ipil
	II-B	5	Hillside Work	0.045 has. (3)	Grading	
					Simple Terracing	
		6	Stream Work	14 m³	Check Dam	Wet Masonry
		7	Hillside Work	0.1 has	Grading	
		8	Stream Work	523 m³	Check Dam	Wet Masonry (including Counter Dam)
1980	I	1	Hillside Work	0.02 has.	Retaining	Concrete Plate
					Wattling	Bamboo, Taxron
					Simple Terracing	Facine, Sod, Talahib, Cogon
					Planting	Giant Ipil-ipil, Agoho
					Water Channel	Dry Masonry

YEAR	PARCEL	NO.	WORK	AREA/VOLUME	KIND OF WORK	FOR MATERIAL USE
		2	Hillside Work		Retaining Water Channel Simple Terracing Planting Wattling	Concrete Plate Dry Masonry Talahib, Samon Giant Ipil-ipil, Agoho Bamboo
		3	Hillside Work	0.03 has.	Retaining Water Channel Wattling Simple Terracing Planting	Concrete Plate Dry Masonry Bamboo, Taxiron Net Talahib Giant Ipil-ipil
1981	I	1	Stream Work	80 m^3	Check Dam	Concrete
	III	2	Stream Work	21 m^3	Check Dam	Concrete
	I	3	Hillside Work		Wattling Simple Terracing Planting	Bamboo Talahib Giant Ipil-ipil, Kakawate
		4	Hillside Work		Retaining Wattling Simple Terracing Planting	Concrete Plate Bamboo Talahib, Cogon, Samon Giant Ipil-ipil
		5	Hillside Work		Wattling Simple Terracing Planting	Bamboo Talahib Giant Ipil-ipil
		6	Hillside Work		Retaining Wattling Simple Terracing Planting	Gabion Taxiron Net, Bamboo Talahib, Other grasses Giant Ipil-ipil, Kakawate
		7	Hillside Work		Retaining Wattling Simple Terracing Planting	Concrete Bamboo, Taxiron Net Talahib, Other grasses Giant Ipil-ipil

YEAR	PARCEL	NO.	WORK	AREA/VOLUME	KIND OF WORK	FOR MATERIAL USE
1982	I	1	Stream Work	35 m^3	Check Dam	Concrete
		2	Hillside Work		Retaining Wattling Simple Terracing	Gabion Bamboo Giant Ipil-ipil, Other grasses
		3	Hillside Work		Retaining Wattling Simple Terracing Planting	Gabion, Concrete Bamboo Talahib, Other grasses Giant Ipil-ipil, Kakawate
		4	Hillside Work		Retaining Wattling Simple Terracing Planting	Gabion Bamboo Cogon, Talahib Giant Ipil-ipil, etc.
		5	Hillside Work		Retaining Wattling Simple Terracing Planting	Concrete Plate Bamboo Cogon, Talahib A. auriculiformis
		6	Hillside Work		Retaining Wattling Simple Terracing Planting	Concrete Plate Bamboo Napier grass Giant Ipil-ipil, etc.
		7	Stream Work Hillside Work	 5.6 m^3	Check Dam Wattling Simple Terracing Retaining Planting	Concrete Bamboo Napier grass Concrete Giant Ipil-ipil, etc.
		8	Stream Work	22 m^3	Check Dam	Concrete

YEAR	PARCEL	NO.	WORK	AREA/VOLUME	KIND OF WORK	FOR MATERIAL USE
1983	I	1	Hillside Work		Retaining Wattling Simple Terracing Planting	Concrete Plate Bamboo Napier grass Giant Ipil-ipil, etc.
		2	Hillside Work		Retaining Wattling Simple Terracing Planting	Concrete Plate Bamboo Napier grass Giant Ipil-ipil, etc.
		3	Hillside Work		Retaining Wattling Simple Terracing Planting	Concrete Plate Bamboo Napier grass, Sun flower Giant Ipil-ipil
		4	Hillside Work		Retaining Simple Terracing Planting	Soil Bag, Concrete Plate, Concrete Block Napier grass Giant Ipil-ipil, etc.
		5	Stream Work	6.0 m^3 38 m^3	Check Dam Retaining	Gabion Wet Masonry
		6	Stream Work Hillside Work	6.0 m^3	Check Dam Retaining	Gabion Concrete Plate
1984	I	1	Stream Work		Check Dam	Concrete
		2	Stream Work		Over Flow	Concrete
		3	Hillside Work		Wattling Water Channel Simple Terracing Planting	Bamboo Corrugate Napier grass
		4	Hillside Work		Retaining Water Channel	Concrete Plate Corrugate

YEAR	PARCEL	NO.	WORK	AREA/VOLUME	KIND OF WORK	FOR MATERIAL USE
1985	I	1	Stream Work		Check Dam	Gabion
		2	Stream Work	2 m^3	Check Dam	Concrete
		3	Stream Work	18 m^3	Revetment	Wet Masonry
		4	Hillside Work		Retaining Simple Terracing Matting Wattling Planting	Concrete Plate Cogon Banding Cogon Mat Cogon Banding A. auriculiformis, etc.

YEAR	PARCEL	No.	WORK	AREA/VOLUME	KIND OF WORK	FOR MATERIAL USE
1986	I	1	Stream Work	5 m^3	Check Dam	Concrete
		2	Stream Work	51 m^2	Revetment	Wet Masonry
		3	Hillside Work	0.02 has.	Water Channel Retaining Wattling Matting Planting	Corrugate Concrete Cogon Banding Cogon Mat A. auriculiformis, etc.
		4	Hillside Work	0.04 has.	Retaining Wattling Matting Planting	Concrete Plate Cogon Banding Cogon Mat Kakawate, etc.
		5	Hillside Work	0.03 has.	Closed Conduit Wattling Matting Planting	Fascine Cogon Banding, Fascine Cogon Mat Giant Ipil-ipil, Kakawate
		6	Hillside Work	0.02 has.	Water Channel Wattling Matting Planting	Sod, Cogon Banding Cogon Banding, Fascine. Cogon Mat
		7	Hillside Work	0.15 has.	Retaining Water Channel Wattling Frame Matting Planting	Gabion, Wet Masonry, Concrete Plate Wet Masonry, Cogon Banding Cogon Banding Cogon Banding Cogon Mat Giant Ipil-ipil, Kakawate, etc.

Table 10 - 2. SURVEYS ON FOREST CONSEVATION

ITEMS	ACHIEVEMENT
1. Survey on Surface Erosion	Comparative test on surface erosion was conducted in forest land, grassland and openland by driving-in pins in set plots. The ground level was marked on the pin. Then measurement was done after the rainy season from the marked spot to the new ground level. The value difference represents the volume of soil loss by surface erosion. The results of the survey based on the data gathered are as follows:
2. Survey on Movement of Soil on Hillside	Two plots were set up in forest land and grassland, and each plot was enclosed with concrete plates. Volume of soil loss was measured from the enclosure after every rainy season. During the first year, the volume of soil loss from the grassland was five times as much as that from the forest land. But in the second year, the concrete plots were destroyed and it was impossible to continue the survey study.
3. Survey on the Rate of sedimentation in sub-watershed area	The procedure was to measure the area of the sub-watershed where check dams were preciously constructed and to calculate the estimated volume of sedimentation. After a year, when the rainy season ended, sedimentation measurement was again undertaken and volume of accumulated sediments was also calculated. The resulting volume was then subtracted from the volume estimated in the preceding year. The result indicates the volume of eroded soil in the sub-watershed for a period of one year. The survey revealed a sedimentation rate of 5 cubic meter/ha/yr.
4. Survey on Soil Temperature and Soil Moisture	The survey was conducted in three different sites, forest land, grassland and open land. Soil temperature and soil moisture were measured at different depth of 5 cm, 15 cm and 25 cm in all three sites. The result of the survey shows that the soil temperature in openland was the highest in all the depths of measure-

	Value of Erosion/yr. cm	Ratio of Erosion
Forest Land	0.05	1
Grass Land	0.49	10
Open Land	1.54	31

ITEMS	ACHIEVEMENT
	ment followed by grassland and the lowest in the forest land. The soil temperature varies with depth. It was observed in the three depths of measurement is very great compared with that in the forest land whose soil temperature has significant difference. The survey had drawn a conclusion that forest in fact has a great influence on soil moisture tenpareture. On the other hand, soil moisture is highest in the forest land at 5 cms deep. However, the soil moisture is lower at 50 cms deep copared with the grassland and open land. This observation is perhaps attributed to the transpiration of trees.
5. Survey on Penetration	This survey was again conducted in forest land, grassland and open land. It is said that forest has the capability to increase the volume of ground water by allowing rainwater to penetrate into the soil. This survey aims to study the effect of afforestation in this project in terms of water conservation. The result of the survey is as follows: The result of the survey shows that afforestation in Parcel Ⅰ and Parcel Ⅱ-A is effective in increasing the capacity of water penetration. With regards to soil type, soil in Parcel Ⅱ-A is good for penetration while the soil of Parcel Ⅰ is not good.
6. Metheorological Observation	A weather station in the Training Center has been installed with rain gauge, apparatus for wind velocity and direction, sunlight recorders, etc. Measurements were undertaken every day but a part of the data are lacking because of inexperienced operation. A short term Expert was dispatched in 1986 and prepared a manual on equipment handling. With this development, progress in the survey techniques is expected. With the rainfall data gathered from the weather station a study of hourly rainfall for erosion control planning and designing has already been started.

Table 11. DISPATCH OF LONG TERM EXPERTS

CATEGORY	NAME	PERIOD
1. Chief Adviser	Sumihiko Asakawa	1976.11.24～1978.11.23
	Senshi Nanba	1978.11.13～1980.11.12
	Takashi Fujimura	1980.10.25～1983. 8.30
	Ikujiro Osaki	1983.10. 1～1985. 9.30
	Hitoshi Kato	1985. 9.20～1987. 9.19
2. Experts		
Silviculture	Masanori Tanaka	1976.11.24～1978.11.23
Forest Conservation	Masayoshi Shinagawa	1977. 8. 3～1979. 8. 2
Forest Management	Osamu Takasawa	1977. 8. 3～1979.11. 2
Forest Management (Project Leader)	Ryoya Shimada	1978.10.16～1980.10.15
Silviculture	Yoshitaka Yanagisawa	1978.10.16～1980.10.15
Silviculture	Katsusuke Okada	1978.11.13～1980.11.12
Forest Coservation	Susumu Tanoue	1979. 6.15～1981. 6.30
Erosion Control (Project Leader)	Norio Sakai	1980. 2.15～1983. 2.14
Forest Management	Kunihiro Kamijo	1980. 3.28～1982. 3.27
Forest Management (Project Leader)	Bunemon Kosugiyama	1980. 9.26～1982. 9.25
Silviculture	Setsuo Koyama	1980. 9.26～1983. 9.25
Silviculture (Project Leader)	Shinji Tanabe	1980.11. 4～1983.11. 3
Watershed Management	Kunihiko Ishizaki	1980.11. 4～1982.11. 3
Forest Conservation	Kiyoshi Iwai	1980.11. 4～1983.11. 3
Plantation Machinery	Akira Yasue	1982. 1.16～1984. 1.15
Forest Conservation	Kiyohiro Yamazaki	1982. 1.16～1984. 1.15
Forest Management	Hajime Naganawa	1982. 4. 1～1984. 9.31
Forest Management (Project Leader)	Tsutomu Handa	1982. 4. 1～1987. 7.23
Erosion Control Planning & Design	Yasukuni Yanagihara	1982. 9.20～1984. 9.19
Forest Environment	Shoji Fukuda	1983. 1.29～1986. 1.28
Silviculture	Tadashi Niino	1983.10. 1～1986. 9.30

CATEGORY	NAME	PERIOD
Erosion Control Facility Construction	Takeshi Kanazawa	1983.12.16～1985.12.15
Forest Machine	Katsumi Takeuchi	1984. 1.20～1986. 1.19
Erosion Control Facility Construction	Masayuki Tojo	1984. 1.21～1986. 5.20
Forest Management	Shuji Yamashita	1984. 3.23～1986. 3.22
Erosion Control Planning & Design (Project Leader)	Masatoshi Iwata	1984. 4. 7～1986. 4. 6
Erosion Control Planning & Design	Nobumori Hashioka	1985. 2. 5～1987. 2. 4
Erosion Control Facility Construction	Kenichi Takano	1985.12. 2～1987. 7.23
Forest Environment	Setsuo Koyama	1986. 1.15～1987. 7.23
Erosion Control Planning & Design (Project Leader)	Mitsuo Uchigashima	1986. 3.23～1987. 7.23
Erosion Control Facility Construction	Fumio Asaka	1986. 5.20～1987. 7.23
3. Liaison Officer	Nobuhito Hobo	1979. 6.15～1981. 6.30
	Ryo Kuroki	1982. 1.16～1984. 1.15
	Satoru Shimazaki	1984. 1. 6～1986. 1. 5
	Ichiro Nakasawa	1985.12. 2～1987. 9.19

Table 12. DISPATCH OF SHORT TERM EXPERTS

NAME	CATEGORY	PERIOD	OFFICE/COMPANY
1. Kota Yamate	Tree Breeding	March 26, 1977~ June 27, 1977	Forest Tree Breeding Institute
2. Akira Kinugawa	Forest Management	-do-	Forestry Agency
3. Takao Kobayashi	Forest Pathology	Aug. 3, 1977~ Oct. 2, 1977	Forestry and Forest Products Research Institute
4. Teruhiko Kawahara	Forest Ecology	-do-	-do-
5. Tadao Yokokoji	Forest Machinery	Aug. 30, 1977~ Sept. 29, 1977	Forest Engineering Co. Ltd.
6. Tomoyoshi Naganuma	Nursery Facility	-do-	Yaesu Industries Co. Ltd.
7. Masaharu Konno	Model Infrastructure	July 27, 1978~ Jan. 22, 1979	Japan Forest Civil Engineering Consultants Foundation
8. Yasushi Morikawa	Forest Physiology	Aug. 1, 1978~ Sept. 30, 1978	Forestry and Forest Products Research Institute
9. Hideo Yenase	Erosion Control	Aug. 30, 1978~ Oct. 30, 1978	-do-
10. Kozo Ohira	Forest Road	Feb. 21, 1979~ April 20, 1979	Japan Forest Civil Engineering Consultants Foundation
11. Yukio Aoki	Forest Machinery	Jan. 30, 1980~ Feb. 29, 1980	Iwate Fuji Industries Co. Ltd.
12. Shoji Umehara	Bridge Construction	Jan. 30, 1980~ March 29, 1980	Japan Forest Civil Engineering Consultants Foundation
13. Kenjiro Morita	Experiment Design	Jan. 30, 1980~ April 29, 1980	Forestry and Forest Products Research Institute

NAME	CATEGORY	PERIOD	OFFICE/COMPANY
14. Hisayoshi Yagi	Forest Soil	-do-	-do-
15. Masaharu Konno	Pilot Infrastructure (design)	Aug. 10, 1980~ Sept. 9, 1980	Japan Forest Civil Engineering Consultants Foundation
16. Hirotomo Arai	-do-	-do-	-do-
17. Hirotomo Arai	Pilot Infrastructure (supervisor)	Jan. 10, 1981~ Jan. 20, 1981	-do-
18. Hiroshi Motohashi	-do-	-do-	-do-
19. Shun Yoneda	-do-	Jan. 10, 1981~ June 27, 1981	-do-
20. Yukio Aoki	Forest Machinery	Feb. 15, 1981~ March 31, 1981	Iwate Fuji Industries Co. Ltd.
21. Yoshikatsu Takahashi	-do-	-do-	-do-
22. Hisayoshi Yagi	Site Classification	Feb. 16, 1981~ April 15, 1981	Forestry and Forest Products Research Institute
23. Masao Ando	Forest Road	Feb. 22, 1981~ April 21, 1981	Japan Forest Civil Engineering Consultants Foundation
24. Kuniyasu Sagara	Audio- Visual Equipment	Feb. 6, 1982~ Feb. 28, 1982	Image Information Services
25. Yasukuni Yanagihara	Watershed Management	May 14, 1982~ Aug. 13, 1982	Forestry Agency
26. Yoshiyuki Fujimoto	Nursery	Aug. 2, 1982~ Oct. 1, 1982	Forest Tree Breeding Institute
27. Kimihisa Murakami	Eroision Control	Nov. 1, 1982~ Nov. 30, 1982	Forestry and forest Products Research Institute
28. Shunji Kudo	Model Infrastructure (design)	March 18, 1983~ April 17, 1983	Japan Forest Civil Engineering Consultants Foundation

NAME	CATEGORY	PERIOD	OFFICE/COMPANY
29. Hiroo Sasaki	Model Infrastructure (design)	March 18, 1983~ April 17, 1983	Japan Forest Civil Engineering Consultants Foundation
30. Shunji Kudo	Model Infrastructure (supervisor)	Aug. 26, 1983~ Dec. 27, 1983	-do-
31. Hiroo sasaki	-do-	Aug. 26, 1983~ Dec. 10, 1983	-do-
32. Akiomi Yamane	Forest Insect	Nov. 23, 1983~ Dec. 22, 1983	Forestry and Forest Products Research Institute
33. Sumihiko Asakawa	Forest Soil	Nov. 27, 1983~ Dec. 16, 1983	-do-
34. Shunji Kudo	Erosion Control Facility Construction	Jan. 21, 1984~ March 16, 1984	Japan Forest Civil Engineering Consultants Foundation
35. Iwasuke Yamaguchi	Erosion Control	Jan. 21, 1984~ April 20, 1984	-do-
36. Kikuji Kunugise	Experimental Machinery	Feb. 11, 1984~ Feb. 25, 1984	Tanifuji Machine Industries Co. Ltd.
37. Masayuki Araki	Meteorological Observation	Aug. 31, 1984~ Sept. 20, 1984	Forestry and Forest Products Research Institute
38. Iwasuke Yamaguchi	Erosion Control	Nov. 9, 1984~ Dec. 21, 1984	Japan Forest Civil Engineering Consultants Foundation
39. Hisayoshi Yagi	Site Classification	-do-	Forestry and Forest Products Research Institute
40. Shunji Kudo	Design for Model Nursery Construction	Dec. 1, 1984~ Dec. 21, 1984	Japan Forest Civil Engineering Consultants Foundation
41. Takao Kobayashi	Forest Pathology	Jan. 10, 1985~ Feb. 19, 1985	Forestry and Forest Products Research Institute

NAME	CATEGORY	PERIOD	OFFICE/COMPANY
42. Akiomi Yamane	Forest Insect	Jan. 10, 1985~ Feb. 19, 1985	Forestry and Forest Products Research Institute
43. Shunji Kudo	Nursery Operation	Jan. 15, 1985~ March 23, 1985	Japan Forest Civil Engineering Consultants Foundation
44. Takashi Kato	Socio-economic Survey	Feb. 18, 1985~ March 17, 1985	Forestry and Forest Products Reswarch Institute
45. Akiomi Yamane	Forest Insect	Sep. 13, 1985~ Oct. 12, 1985	University of Tokyo
46. Masanori Suyama	Erosion Control	Nov. 1, 1985~ Nov. 30, 1985	Forestry and Forest Products Research Institute
47. Akiomi Yamane	Forest Insect	Jan. 17, 1986~ Feb. 16, 1986	University of Tokyo
48. Sumihiko Asakawa	Silviculture	Jan. 26, 1986~ Feb. 6, 1986	Forestry and Forest Products Research Institute
49. Takashi Kato	Forest Environment	April 3, 1986~ May 17, 1986	-do-
50. Hisayoshi Yagi	Forest Soil	April 8, 1986~ May 2, 1986	-do-
51. Shigeru Iida	Forest Management	April 8, 1986~ May 22, 1986	Forestry Policy Research Institute
52. Shigeru Motoki	Forest Fire	May 10, 1986~ May 30, 1986	Former Forestry and Forest Products Research Institute
53. Akiomi Yamane	Forest Insect	Aug. 2, 1986~ Aug. 28, 1986	University of Tokyo
54. Keiko Niijima	Forest Soil Biology	-do-	Forestry and Forest Products Research Institute

NAME	CATEGORY	PERIOD	OFFICE/COMPANY
55. Masayuki Araki	Meteorological Observation	Aug. 8, 1986~ Sept. 4, 1986	Forestry and Forest Products Research Institute

Table 13. DISPATCH OF MISSIONS

1.	Object	Cooperation Planning Basic Surveys
	Period	April 3 - May 14, 1975
	Leader	Hideo Takehara Former Director of Forestry and Forest Products Research Institute
	Member	7 persons
2.	Object	Consultation for Forestry Technical Cooperation Project
	Period	October 1 - 10, 1975
	Leader	Katsuhiro Kotari Special Assistant to the President of JICA
	Member	4 persons
3.	Object	Surveys for Design of Plans and Project
	Period	December 3 - 27, 1975
	Leader	Hideo Takehara
	Member	5 persons
4.	Object	2nd Basic Surveys
	Period	December 3 - 27, 1975
	Leader	Tadami Imai Japan Forestry Technical Association
	Member	2 persons
5.	Object	Consultation for Record of Discussions
	Period	June 10 - 19, 1976
	Leader	Katsuhiro Kotari
	Member	4 persons
6.	Object	Feasibility Studies for Reforestation Project by Private Sector
	Period	February 8 - March 5, 1977
	Leader	Hideo Takehara
	Member	8 persons
7.	Object	Consultation for Establishment of Forest Conservation Training Center
	Period	August 3 - 13, 1977
	Leader	Katsuhiro Kotari
	Member	5 persons
8.	Object	Surveys for Detailed Designs of Conservation Training Center
	Period	September 26 - October 22, 1977
	Leader	Katsuhiro Kotari
	Member	11 persons

9.	Object	Surveys for Detailed Designs of Forest Roads and Nursery	
	Period	October 19 - November 17, 1977	
	Leader	Akinori Sakagawa	Japan Forest Civil Engineering Consultants Foundation
	Member	7 persons	
10.	Object	Reports of Surveys for Detailed Designs of Forest Conservation Training Center	
	Period	February 27 - March 8, 1978	
	Leader	Ryoya Shimada	Assistant Chief of Conservation Division, Forestry Agency
	Member	5 persons	
11.	Object	Technical Guidance for the Project	
	Period	May 3 -12, 1978	
	Leader	Katsuhiro Kotari	
	Member	2 persons	
12.	Object	Technical Guidance for the Project	
	Period	October 9 - 19, 1978	
	Leader	Senshi Nanba	Chief of Conservation Division, Forestry and Forest Products Research Institute
	Member	3 persons	
13.	Object	Technical Guidance for the Project	
	Period	September 14 - 23, 1979	
	Leader	Katsuhiro Kotari	
	Member	4 persons	
14.	Object	Guidance for Agriculture and Forestry, Technical Cooperation Projects	
	Period	November 4 - 5, 1979	
	Leader	Kanji Endo	Director of JICA
	Member	6 persons	
15.	Object	Equipment Maintenance and Management Guidance for the Project	
	Period	November 12 - December 2, 1979	
	Leader	Yoshiyuki Kawai	Forest Engineering Co. Ltd.
	Member	2 persons	
16	Object	The First Guidance for Pilot Infrastructure Improvement Works on the Project	
	Period	June 8 - 25, 1980	
	Leader	Susumu Suzuki	Chief of Forest Development Division, JICA
	Member	4 persons	

17. Object The Second Guidance for Pilot Infrastructure Improvement Works on the Project
Period October 30 - November 8, 1980
Leader Katsuhiro Kotari
Member 3 persons

18. Object Equipment Maintenance and Management Guidance for the Project
Period December 9 - 19, 1980
Leader Yukio Aoki IWAFUJI Industries Co. Ltd.
Member 2 persons

19. Object Surveys for Audio-Visual Aids
Period January 15 - February 6, 1982
Leader Kazuhiko Shigeta Forest Products Division, Forestry Agency
Member 3 persons

20. Object Consultation for New Record of Discussions
Period July 18 - 24, 1982
Leader Katsura Watanabe Director of the Department of Forestry and Fisheries Development Cooperation, JICA
Member 2 persons

21. Object Attendance for Inaguration of Forest Conservation Training Center
Period September 8 - 10, 1982
Leader Katsuhiro Kotari
Member 1 person

22. Object Consultation for Basic Plan of Project
Period September 20 - 30, 1982
Leader Senshi Nanba Director of the Department of Research, Forestry and Forest Products Research Institute
Member 3 persons

23. Object Equipment Maintenance and Mamagement Guidance for the Project
Period October 25 - November 15, 1982
Leader Yoshitaka Okuhara Numata District Office, Forestry Agency
Member 4 persons

24. Object Technical Guidance for the Project
Period August 17 - 30, 1983
Leader Yasushi Nomura Chief of Planning Division, Forestry Agency
Member 3 persons

25.	Object	Guidance for Agriculture and Foredtry, Technical Cooperation Project	
	Period	September 30 - October 5, 1983	
	Leader	Haruo Tsuchiya	Director of the Department of Agriculture, Forestry and Fisheries Planning, JICA
	Member	5 persons	
26.	Object	Technical Guidance for the Project	
	Period	December 10 -14, 1983	
	Leader	Katsuhiro Kotari	
	Member	1 person	
27.	Object	Technical Guidance for the Project	
	Period	September 19 - October 3, 1984	
	Leader	Hisanori Yamamoto	TANIFUJI Machine Industries Co. Ltd.
	Member	1 person	
28.	Object	Technical Guidance for the Project	
	Period	October 9 - 18, 1984	
	Leader	Tsuyoshi Misawa	Chief of Planning Division, Forestry Agency
	Member	3 persons	
29.	Object	Technical Guidance for Afforestation, Technical Cooperation Project	
	Period	March 10 - 13, 1985	
	Leader	Mitsuma Matsui	Adviser, Japan Forestry Technical Association
	Member	2 persons	
30.	Object	Equipment Maintenance and Management Guidance for the Project	
	Period	August 5 - 8, 1985	
	Leader	Yosuke Maekawa	Chief of Second Procurement Division, JICA
	Member	4 persons	
31.	Object	Technical Guidance for the Project	
	Period	November 4 - 13, 1985	
	Leader	Katsuhiro Kotari	
	Member	3 persons	
32.	Object	Technical Guidance for Afforestation, Technical Cooperation Project	
	Period	April 8 - 12, 1986	
	Leader	Kazuto Arimitsu	Chief of Soil Research Division, Forestry and Forest Products Research Institute
	Member	2 persons	

33. Object Advance Evaluation and Technical Guidance for the Project
Period Sptember 2 - 9, 1986
Leader Katsuhiro Kotari
Member 2 persons

Table 14 - 1. SUPPLY OF EQUIPMENT AND MACHINERY BY THE JAPANESE GOVERNMENT

Unit : 1,000 Yen

FISCAL YEAR	1977	1978	1979	1980	1981	1982
AMOUNT	168,571	102,249	84,557	92,179	95,314	80,824

FISCAL YEAR	1983	1984	1985	1986	TOTAL
AMOUNT	68,809	82,334	86,016		860,853

Table 14 - 2. LIST OF MAJOR EQUIPMENT AND MACHINERY SUPPLIED BY THE JAPANESE GOVERNMENT

(AS OF SEPTEMBER 1986)

CATEGORY	NAME AND MODEL	YEAR ACQURED	NO.	AMOUNT (UNIT) (1,000YEN)	SITUATION		REMARKS
					UTILI-ZATION	MAINTE-NANCE	
SERVICE JEEP	TOYOTA L/C HT FJ40LV-UC	1977	2	1,863	A	A	
SERVICE JEEP	TOYOTA L/C HT FJ40LV-UC	1978	1	1,696	A	A	
SERVICE JEEP	TOYOTA L/C HT FJ40LV-UC	1980	1	1,681	A	A	
SERVICE JEEP	TOYOTA L/C HT FJ40LV-KC	1984	2	1,927	A	A	
STATION WAGON	TOYOTA CROWN S/S MS122LG-SWMGS	1984	1	2,714	A	A	
STATION WAGON	TOYOTA L/C SW FJ55LV-UC	1977	2	2,500			ABOLISHED
STATION WAGON	TOYOTA L/C SW FJ60LV-KC	1983	1	2,359	A	A	TRAINING CENTER
STATION WAGON	TOYOTA L/C SW BJ60LV-KC DIESEL	1985	1	2,575	A	A	TRAINING CENTER
PICK-UP	TOYOTA L/C PU FJ45LP-U L.HD.	1978	1	1,483			ABOLISHED
PICK-UP	TOYOTA L/C PU FJ45LP-U	1979	1	1,663	A	A	
PICK-UP	TOYOTA L/C PU FJ45LP-U DIESEL	1979	1	1,416	A	A	
PICK-UP	TOYOTA L/C PU HJ47LP-K	1980	2	1,707			ABOLISHED
PICK-UP	TOYOTA L/C PU HJ47LP-K	1980	1	1,707	A	A	
PICK-UP	TOYOTA L/C PU BJ45LP-K DIESEL	1981	1	1,845			ABOLISHED
PICK-UP	TOYOTA L/C PU BJ45LP-K DIESEL	1983	1	2,117	A	A	TRAINING CENTER
PICK-UP	TOYOTA L/C PU BJ45LP-K DIESEL	1984	2	1,938	A	A	
PICK-UP	TOYOTA L/C PU BJ75LP-KR DIESEL	1985	1	2,277	A	A	TRAINING CENTER
JEEP	SUZUKI LJ80VL	1981	1	670	A	A	
BUS	NISSAN CIVILIAN 60ZGHQLC 340WC	1981	1	3,024	A	A	
BUS	TOYOTA COASTER BB20L-MDZR	1983	1	3,833	A	A	TRAINING CENTER
CARGO TRUCK	MITSUBISHI FUSO DIESEL FK102KL	1977	1	2,035			ABOLISHED
CARGO TRUCK	MITSUBISHI FUSO DIESEL FK102KL	1977	1	2,035	D-1		
TRUCK	ISUZU SBR372	1979	2	2,200			ABOLISHED
CARGO CRANE TRUCK	ISUZU SBR372RL, TADANO TM-20B	1979	1	3,803	A	A	