

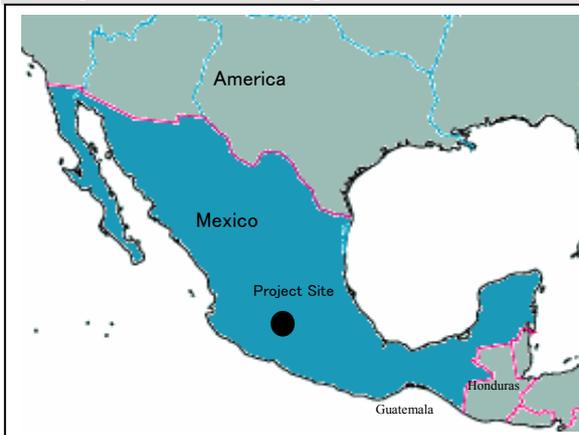
## Mexico

### Mexico Metropolitan Area Reforestation Project

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Field Survey: August 2005

#### 1. Project Profile and Japan's ODA Loan



Map of Project Area



Reforestation through the Project

#### 1.1 Background

During the first half of the 1990s, the population of Mexico's capital metropolis reached 21 million, one-fourth of the country's total population. This large metropolis accounted for roughly 36% of the country's gross national product and nearly 20% of its gross national energy consumption. Under these conditions the air pollution problem is growing increasingly worse. In 1991, the metropolitan area experienced 346 days where the ozone concentration exceeded the environmental standard, and the level of total suspended particulates (TSP) climbed to nearly three times the standard value. These pollutants have a negative impact on the human body and respiratory ailments in particular, so countermeasures for them were urgently needed. In view of this, the Mexican government made "improvement of peoples' lives" one of the targets of the 1989 to 1994 National Development Plan, and in 1990 the Metropolitan Program to Combat Atmospheric Pollution (PICCA) was initiated for the metropolitan area. This plan called for increasing the amount of forest coverage to clean pollutants from the air, and so the reforestation project was planned around the Metropolitan area.

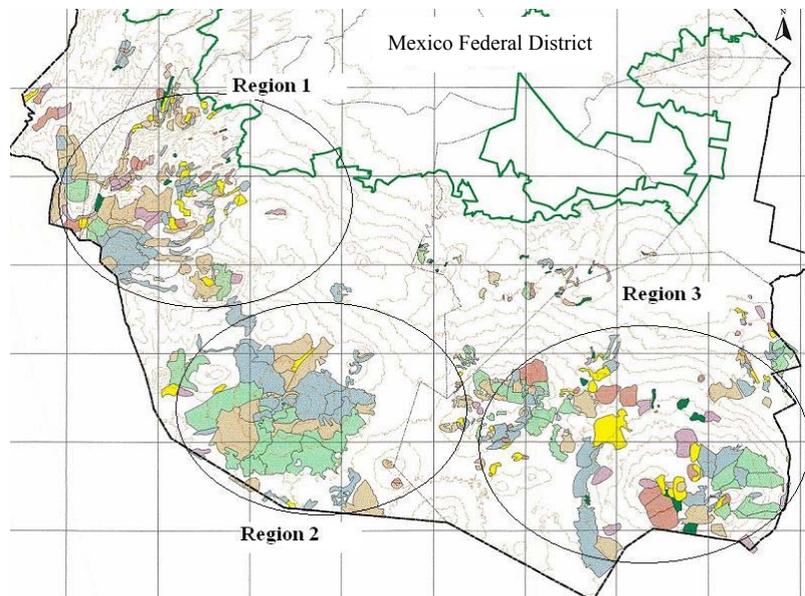
#### 1.2 Objective

The purpose of this project was to construct nursery grounds to raise seedlings in the southern part of the Mexico metropolitan area and reforest a total of 55,600 ha<sup>1</sup> of land to increase the amount of forested land in order to reduce the amount of atmospheric

<sup>1</sup> Number of hectares in the initial plan. The scope was changed to 40,000 ha during the project. (Refer to page 3 hereafter.)

pollutants in the metropolitan area and purify the atmosphere, thereby contributing to the improvement of the living and lifestyles of the residents.

Fig. 1 Project Site (Mexico Federal District Southern Area Regions 1 to 3)



### 1.3 Borrower/Executing Agency

Borrower	Government of the United Mexican States
Executing Agency (at appraisal)	Mexico Metropolitan Environmental Commission (CPCCA)
	Mexico Federal District Ministry of the Environment (at evaluation)
O&M Agency	Mexico Federal District Commission of Rural Development Coordination (COCODER) (at appraisal)
	Commission for Natural Resources and Rural Development (CORENADER) (at evaluation) <sup>2</sup>

### 1.4 Outline of Loan Agreement

Loan Amount/ Disbursed Amount	10,403 million yen/7,945 million yen
Exchange of Notes Loan Agreement	September 1992 October 1992
Terms and Conditions	

<sup>2</sup> Mexico Federal District Commission of Rural Development Coordination (COCODER) was reorganized to the Commission for Natural Resources and Rural Development (CORENADER) in 1995.

- Interest Rate	5.0%
- Repayment Period (Grace Period)	25 years (7 years)
- Procurement	General untied
Final Disbursement Date	February 2004
Main Agreement	Sumitomo Corporation
Consulting Agreement	Chuo Kaihatsu Corporation
Feasibility study (F/S), etc.	1989 by Mexican government

## 2. Evaluation Result

### 2.1 Relevance

In the National Development Plan (1989-1994), the Mexican government raised “improvement of peoples’ lives” as a major goal, showing its proactive stance towards environmental issues. The government initiated the above mentioned Metropolitan Program to Combat Atmospheric Pollution (PICCA) to achieve this goal, and conducted a variety of activities for the following specific programs: (1) Improvement of fuel quality, (2) Reduction of automobile exhaust gases, (3) Promoting the use of natural gas, and (4) Restoration of natural resources. The purpose of the project was to reforest areas where the forest had been depleted to utilize the air purification effect of forests to reduce air pollution in the metropolitan area, and so it was given a high priority. For this reason, the relevance of the project at the time of appraisal was high.

Anti-air pollution measures, including reforestation projects, remain an important government policy in the current National Development Plan (2001-2006). This plan calls for “harmony between development and nature” and has listed alleviation of atmospheric pollution and energy consumption, forest conservation, and water resource conservation as priority indicators. Of these, the importance of reforestation projects has been pointed out from a variety of perspectives because these projects alleviate air pollution, counter soil erosion, and protect the ecosystem. The metropolis is currently conducting the Program to Improve the Air Quality in the Valley of Mexico Phase 2 (PROAIRE 2)<sup>3</sup> as the successor program to the above PICCA, but there are no major changes in the policy framework or priority areas of the successor program from those of PICCA, including reforestation projects. This project was important for alleviating the above problems and the relevance of the project continues to be recognized today.

<sup>3</sup> As the successor program to PICCA, PROAIRE Phase 1 (1995-2000) was conducted and is currently in Phase 2 (2002-2010).

## 2.2 Efficiency

### 2.2.1 Outputs

The scope of the project included the construction of tree nursery grounds, reforestation projects, and forest road improvements in the Mexico Federal District, the State of Mexico, and the State of Morelos. The parts of the project covered the yen-based financing are given below.

Project Item	Plan	Revised Plan (2001)	Actual Performance
1) Nurseries Ground	1. Nursery ground: Nursery building, germination house, equipment storehouse, training building, etc. 2. Equipment procurement: Nursery pots, potting soil, fertilizer, small trucks, bulldozers, etc.	1. No change 2. No change	1. Nearly according to plan 2. Nearly according to plan
2) Reforestation Projects	Reforestation area: 55,600 ha (Number of transplanted trees 91 million)  1. Mexico Federal Dist.: 26,600 ha 2. State of Mexico: 18,837 ha 3. State of Morelos: 10,163 ha	40,000 ha (60 million trees)  40,000 ha Cancelled Cancelled	32,676 ha (62.84 million trees)  32,676 ha Cancelled Cancelled
3) Forest Road Improvements	Total extension: 623 km  1. Mexico Federal Dist.: 283 km 2. State of Mexico: 240 km 3. State of Morelos: 100 km	Total extension: 267 km 1. 267 km 2. Cancelled 3. Cancelled	Total extension: 170.57 km 1. 170.57 km 2. Cancelled 3. Cancelled
4) Other	1. Construction of fire watchtowers: 9 towers	1. 12 towers (3 towers added)	1. Constructed fire watchtowers: 9

	2. Repair of existing facilities: 4 facilities	No change	towers 2. Repaired existing facilities 4 facilities
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In October 1998, the states of Mexico and Morelos, which oversaw part of the project area, withdrew from the project citing financial difficulty as the reason, so the scope of the project was reduced from the initial plan. Screening of the Commission for Natural Resources and Rural Development (hereinafter stated as “CORENADER”), the executing agent, revealed that the actual reason for the withdrawals was the influence of political confrontation brought about by changes of administration in the local governments. After discussions between CORENADER and Japan Bank of International Cooperation (JBIC) in 2001 to revise the project objective, it was decided to reduce the scope of the project to just the Mexico Federal District (See the revised plan in the central column of the above table). The final result was that although the planned site for constructing the nursery grounds was changed, an output nearly according to plan was achieved. The reforestation project, however, was only conducted in the Mexico Federal District due to the withdrawal from the project of the states of Mexico and Morelos. At the conclusion of the project, 32,676 ha<sup>4</sup> had been reforested (59% of the initial plan) and 170.57 km of forest road improvements were completed (27% of the initial plan), so the scale of both these aspects was reduced. The reason for the significant reduction in forest road improvements in addition to the withdrawal from the projects of the states of Mexico and Morelos was opposition to the use of the necessary land by some farming communities in the target area<sup>5</sup>. Additional output of the project was an Environmental Education Center<sup>6</sup> constructed adjacent to the nursery ground at government expense. It was decided to build this center at Mexican government expense due to the increasing recognition of the need for environmental education accompanying the serious state of the air pollution, and it was constructed next to the nursery ground in 1995.

<sup>4</sup> 327 km<sup>2</sup>. This is an area comparable to approximately 10 times the size of Suginami Ward in Tokyo (34 km<sup>2</sup>) or of 7,000 Tokyo Domes.

<sup>5</sup> There are some farming communities in the project area that have the traditional custom of wanting to keep their land, and the executing agent was unable to convince them to cooperate with the project.

<sup>6</sup> The Environmental Education Center runs environmental education programs and tours for mostly young people, and features such exhibits as an ecosystem museum, a honey farm, a mini nursery, and a hands-on learning corner. Students account for 95% of the visitors, and the center is used for field trips and training for elementary school students in particular. The annual average number of visitors from 1995 to 2003 was roughly 33,000 people, and the total for this period exceeded 296,000 people.

Fig. 2 Nursery seedling growing area



Fig. 3 Seed selecting by community residents



### 2.2.2 Project Period

The total period at appraisal was estimated to be 80 months from January 1993 to August 1999, but it actually took 134 months (168% of the initial plan) from the project start in January 1993 until February 2004. The main reasons for the extension of the construction period were (1) delay in the project starting time due to a change in the executing agency, (2) nursery construction delay<sup>7</sup> due to a delay in starting procurement procedures and the construction of additional output (Environmental Education Center), (3) interrupt of construction by natural disasters including the El Nino effect that occurred from 1997 to 1998, and (4) a delay in land acquisition negotiations due to insufficient domestic currency. Since the reforestation project uses seedlings raised in the nursery, the delay in the completion of the nursery delayed the reforestation project.

### 2.2.3 Project Costs

At appraisal 10,430 million yen (approximately 60%) of the total project cost of 17,339 million yen was to be financed by official development assistance (ODA) loans with the remaining 40% to be self-funded by the Mexican government. Of the final total project cost, 18,235 million yen, 7,945 million yen (approximately 44%) was financed through ODA loans. The reduction in the ODA financing portion of the project (reduced to 76% of the initial plan) was due to the reduction<sup>8</sup> in project cost by the withdrawal of the states of Mexico and Morelos from the project. The total project cost increased slightly, 105% of the initial plan, due mainly to (1) expenses accompanying contracting out the management of the nursery<sup>9</sup> and (2) and the self-funded construction of the

<sup>7</sup> The additional output of the Environmental Education Center also functions as a testing center for the production technology and equipment used by the nursery, so it was constructed ahead of the nursery itself.

<sup>8</sup> Initially, the amount of 2,216 million yen was allocated to the two states (approx. 21% of the initial total project cost).

<sup>9</sup> Two years after construction, operation of the nursery was contracted out to a private entity.

Environmental Education Center as additional output.

## 2.3 Effectiveness

### 2.3.1 Increase in Forest Area

In the plan at appraisal 55,600 ha were targeted for reforestation using approximately 91 million seedlings. The actual reforested area was 32,676 ha using 62.84 million seedlings, which was 59% and 69% of the initial plan, respectively. The reason for the reduction, as was explained in the Section 2.2 “Efficiency,” was the withdrawal from the project of the states of Mexico and Morelos. The results of a reforestation survival rate study conducted in 2004 showed the survival rate to be approximately 63%, which did not meet the target of 70% set by the executing agency, but nevertheless was a high level compared to the international standard<sup>10</sup> of 50%. Reasons given for the high survival rate were (1) selecting of seeds suitable for the transplant area during the nursery seed selection stage and (2) the establishment of an incentive-based operation and maintenance structure run by local residents (See 2.5.2 Operation and Maintenance).

One factor that inhibited an improved survival rate was damage caused by fires set in the reforestation area to clear land for grazing. A study by the executing agency found that approximately 1,600 ha of reforested area in the project area were being destroyed annually by burning. To prevent this destruction, the executing agency is conducting public education activities, such as holding meetings for ranchers in the project area, but these efforts have been ineffective due to the low level of interest in the reforestation project among the ranchers. To improve the survival rate and increase forested area, the future project will need to cooperate with people like them who do not benefit directly from the project and to educate them its meaning and impact.

Table 1. Major Data from the Reforestation Project

Reforestation Area		Plan	Result	% of Plan
Reforestation Area	1. Windbreaks	7,500 ha	1,264 ha	17%
	2. Forest Land Preparation (Tree Cover Under*1 10%)	38,100 ha	13,514 ha	35%
	3. Reforestation of Sparse Forest (Tree Cover 11% to 40%)	10,000 ha	17,898 ha	179%

<sup>10</sup> Standard value of the UN Food and Agricultural Organization (FAO)

	Total	55,600 ha	32,676 ha	59%
Number of Transplanted Seedlings (unit: 10,000)*2		9,100	6,284	69%
Survival Rate		70%	63%	90%
Number of Seedlings Produced (unit: 10,000)		9,100	7,690*3	85%

Source: CORENADER

\*1 Tree cover = Percentage of the surface of the ground in a designated area covered by tree canopy

\*2 The seedling transplant density was 1,900 seedlings/ha.

\*3 The number of seedlings produced is as of the end of the project (2003). The total number produced to date (August 2005) is 89,200,000 seedlings.

### 2.3.2 Preventing and Reducing Forest Fires

This project was expected to reduce damage from forest fires by constructing forest roads and fire watchtowers. The following table shows changes in the number of forest fires occurring and the burned area from the time of appraisal to the present. Improvement was observed in both the number of fires occurring and the amount of burned area after implementation of the project. The damage they cause is greatly affected by external factors, such as the weather conditions, so there is a large fluctuation in these from year to year, making it difficult to accurately assess the effect of the project.

number of fires that occur and



Fig. 4 Fire watchtower

The project activities, however, are deemed to have contributed to reducing the frequency and scale of damage of fires in the following ways: (1) increasing the prevention effect by constructing fire watchtowers and establishing a monitoring system, (2) preventing longer duration and greater damage by building forest roads that serve as fire breaks and as access routes when fires occurs, and (3) establishing a firefighting structure by organizing local residents into fire squads<sup>11</sup>.

Table 2. Forest Fire Damage in the Project Area

<sup>11</sup> See 2.5.2 Operation and Management

	Before Project (1991-1998 Annual Average)	After Project (1999-2004 Annual Average)
Fires/Year	1328.4	713.7
Days of Duration of Fire	5.8	3.1
Fire Occurrence Days/Year	159.4	154.6
Burned Area (ha)/year	3,053	1,220

Source: CORENADER (As of September 2005)

### 2.3.3 Recalculation of the Financing Internal Rate of Return (FIRR)/Economic Internal Rate of Return (EIRR)

The internal rate of return was not recalculated considering that this type of project by nature does not produce income and that it is very difficult to quantify the project effects.

## 2.4 Impact

### 2.4.1 Reduction of Air Pollutants

#### 2.4.1.1 Atmospheric Pollution Purifying Effect Through Reforestation

This project was expected to reduce the amount of air pollutants as represented by the TSP concentration by increasing the reforested areas. The amount of air pollutants emitted in the reforested area has not been measured to date, and since a certain number of years<sup>12</sup> is required to state with certainty the atmospheric pollution purifying effect of the reforestation, the quantitative effect could not be confirmed as of 2005. Reforestation, however, is said to be effective in absorbing suspended particulates, such as soil particles, so a reduction in emissions is expected as the trees in the reforested area grow. Another effect of the project is the atmospheric pollution purifying effect obtained from the reduction of forest fires. In the metropolitan area, emission of atmospheric pollutants from forest fires in 2002 were recorded as being approximately 46 tons of PM<sub>10</sub><sup>13</sup> and 40 tons of PM<sub>2.5</sub> (burned area 1,291 ha), making soot from fires one of the emission sources of atmospheric pollutants. It is difficult to verify quantitatively the contribution of the project, but establishing a forest fire prevention structure is expected to reduce the amount of emissions.

<sup>12</sup> According to CORENADER, it is thought that the type of trees planted require 7 to 8 years at the earliest and 10 to 15 years normally to attain the height necessary (about 5m) to be effective in absorbing atmospheric pollutants.

<sup>13</sup> This is suspended particulates that are polluting the air and include PM<sub>10</sub> = particles with diameters up to 10 micrometer diameters and PM<sub>2.5</sub> = particles with diameters under 2.5 micrometers.

#### 2.4.1.2 Reduced Metropolitan Air Pollution

The following table compares TSP concentration in Mexico City before the project and current status. The introduction of air pollution reduction programs since 1990<sup>14</sup> has greatly reduced the emission of atmospheric pollutants from the time before the project was started. There still are days, however, that exceed the standard and where the level of pollution remains high compared with developed nations. The three major sources of pollutants are automobiles, industrial activities, and daily energy consumption, so comprehensive measures to reduce emissions must be promoted in addition to reforestation projects to make further improvements in the future.

Table 3. Comparison with the Yearly Maximum Values for TSP Concentration for Mexico City

	Before Project (1988)	Currently (2004)
	TSP Concentration (24-hour Average)	TSP Concentration (24-hour Average)
Mexico City	1,494 µg/m <sup>3</sup>	458 µg/m <sup>3</sup>
Tokyo	129 µg/m <sup>3</sup>	29 µg/m <sup>3</sup>
	Number of Days Exceeding Standard/Year	Number of Days Exceeding Standard/Year
Mexico City	83 days	33 days
Tokyo	-	5.6 days

Source: Appraisal materials, (Tokyo) Tokyo Metropolitan Government Bureau of Environment homepage

#### Reference: Research into the Environmental Improvement Effect of the Reforestation Project

In 2003, CORENADER conducted collaborative research with Chapingo University into the carbon fixing effect of the reforestation area. The carbon fixation effect is an indicator that is used to measure the carbon dioxide reduction effect of plants. Plants take carbon dioxide from the air and use it in the production of carbon compounds, and we use this reaction in measuring the reduced amount of carbon dioxide in the atmosphere. The carbon fixing effect is not direct data to prove how much the atmospheric pollutants are reduced, but it is important as data for quantitatively verifying the comprehensive environmental improvement effect of the reforestation project. If the newly planted trees

<sup>14</sup> A variety of programs, such as automobile exhaust restrictions and improved fuel quality, have been implemented since the Metropolitan Program to Combat Atmospheric Pollution (PICCA) was initiated in 1990.

continue to grow well, then an even greater effect can be expected in the future.

Table 4. Carbon Fixing Effect of Forest in the Reforestation Area (2003)

Area	Surface Area (ha)*	Fixed Volume/Year	Fixed Volume/ha
Region 1	2,535 ha	168 t	66.3 kg
Region 2	4,582 ha	460 t	100.3 kg
Region 3	6,989 ha	328 t	46.9 kg
Total	14,106 ha	955 t	67.7 kg

Source: Diagnostico de la cubierta vegetal en el suelo de conservacion del Distrito Federal (2003)

Note: To measure the surface area, sampling was done of some trees in each area to calculate the average values for diameter and height and then the absorption effect per tree and the number of transplanted trees were calculated as a standard.

#### 2.4.2 Effect on Improving the Lives of Local Residents

A questionnaire survey<sup>15</sup> on the project implementation before and after changes in the living environment of residents in the vicinity of the reforestation project was conducted. The survey showed that approximately 90% of the respondents recognized some kind of improvement effect. The results of the questionnaire survey are given below.

#### Results of the Survey of Project Beneficiaries

A questionnaire survey of the changes the project made in the lives of residents in the vicinity of the reforestation area was administered to 100 people of whom 79 responded.

##### Environmental Improvement Effect of the Project

When asked if the project had had a positive impact on the area, approximately 90% responded that it did "There was a positive effect." The reasons given were reduced air pollution (29%), improved state of health (23%), improved quality of life (17%), and other environmental improvements (30%). Of the respondents, 79% said the project had other environmental impacts in addition to reducing atmospheric pollutants. When asked for specific reasons for this, the main responses were improved view (49%), restored ecosystem (26%), and replenishment of the water supply (20%). Interviews of residents

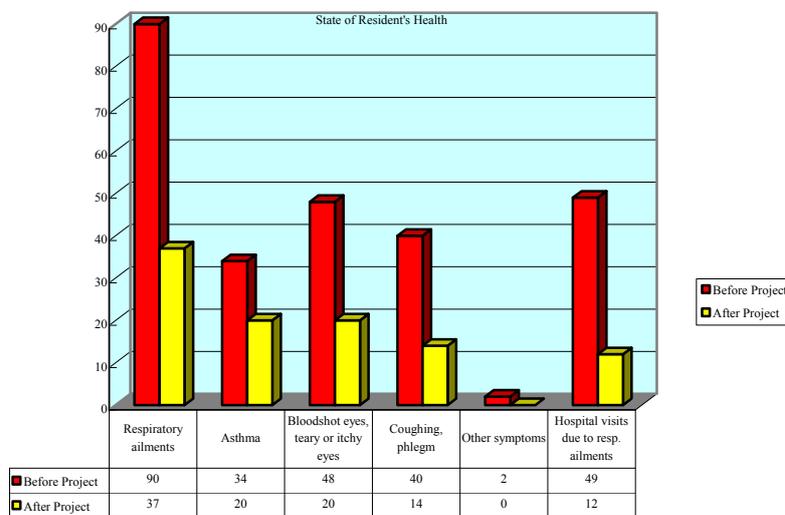
<sup>15</sup> A survey of 100 people from the project area was conducted and responses from 79 people were obtained.

during the site inspection found that they saw an increase in wild animals, such as birds, rabbits, and squirrels, during the past few years as the reforestation progressed, which was used as supporting evidence for the above opinions.

### Health Improvement Effect of the Project

A comparison with the pre-project state of the annual number of cases of respiratory ailments of the questionnaire respondents (79 people) is shown below. A certain improvement effect was observed in all categories, such a reduction in symptoms like coughing and sore eyes.

Fig. 5 Questionnaire Results (Health Improvement of Local Residents)



Source: Prepared by evaluator based on the questionnaire survey (unit: Cases)

As was mentioned in the previous section, a certain period is required to state with certainty the atmospheric pollutants reduction effect of the reforestation project, so at the current time it is difficult to verify the degree of contribution from the ODA financing project. Since the feeling of local residents was that there had been a health improvement effect since the project and as well as several secondary effects, such as recovery of the ecosystem due to the reforestation, so the reforestation project is deemed to have made a certain contribution to the improvement of the area environment.

Further, when the participants of the reforestation incentive program (Described in detail in the Section 2.5 Sustainability) were asked about the economic effect, they responded that the living environment had improved (29%) and that they have increased spending for children’s education (29%) as well as for food (13%) and entertainment (11%). Also, based on experience received from the operation and maintenance of the reforestation project, some residents have started their own commercial forestry enterprises, which shows that this project has improved the economic level of local

residents. Interviews conducted during a site inspection found that the forestry products offered included pine trees to be used as Christmas trees and that the current production area had been expanded to 900 ha.

In addition to this, the earth paving, forest road improvement work, reforestation work, and other work conducted for the project employed approximately 15,800 people. Residents living close to the nursery grounds are also employed there part-time with approximately 130 temporary workers employed there every year during the peak nursery work season (June to August). (See the Section 2.5.2 “Operation and Maintenance”)

Fig.6 Beneficiary  
Interview



## 2.5 Sustainability

### 2.5.1 Executing Agency

#### 2.5.1.1. Technical Capacity

CORENADER supervises the operation and maintenance of the nursery ground. Most of the staff members are graduates of Chapingo University,<sup>16</sup> and no problems were found with the technical level. There were no major problems found with the quality of the operation and maintenance of the nursery ground partly due to the technology transfer conducted when the initial construction was contracted out to private companies. Local residents are in charge of the operation, maintenance, and management of the reforestation project with staff from CORENADER providing guidance and oversight. The Forestry Management and Research Center has been established within the nursery to conduct a wide range of training programs covering such areas as forest tree breeding study, forest fire prevention training, and radio technology training for staff and local residents.

#### 2.5.1.2 Framework

The executing agency at appraisal was the Mexico Metropolitan Environmental Commission (CPCCA), a federal government organization under the direct supervision of the president, and execution, operation, and maintenance was to be handled by agencies from the states planning to participate in the initial project. The withdrawal from the project of the states of Mexico and Morelos left only the Mexico Federal

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<sup>16</sup> This is an independent agricultural university about 40 km from Mexico City. JICA had previously provided guidance in teaching students of this university how to use agricultural machinery as part of an Agricultural Equipment Survey and Evaluation Project Plan (1991 to 2004).

District participating in the project. For this reason the project executing agency was also changed to match the circumstances so that the current executing agency is the Mexico Federal District Ministry of the Environment and the organization in charge of operation and management is the Commission for Natural Resources and Rural Development (CORENADER) from the Ministry of the Environment. CORENADER was initially operated outside of the Ministry of the Environment, but the reorganization of the Federal District in 2000 placed it within the Ministry of the Environment. For the reforestation project after 2005, CORENADER has set the following strategic goals: (1) restoration of deforested lands, (2) promoting the introduction of agro-forest-type forestry, and (3) management and maintenance of existing forests.

Concerning everyday maintenance activities, engineers are assigned to each region where they provide instruction to the community, carry out the incentive program,<sup>17</sup> and conduct monitoring.

#### 2.5.1.3 Financial Status

The detailed financial reports of the executing agency have not been released, so it was not possible to verify the detailed financial condition of the executing agency. CORENADER's annual activity budget for the past five years is indicated in the table below. Because the execution of the reforestation project was completed in 2004, the size of the budget has been reduced. According to the executing agency, the current size of the budget has not been greatly reduced from that planned, so it does not think there are any major problems in operating the nursery ground and reforestation project.

Table 5. CORENADER's Annual Activity Budget  
(Unit: 100 million pesos)

Year	2001	2002	2003	2004	2005
Plan	6.3	6.21	5.3	3.41	2.95
Results	5.16	5.36	2.76	3.38	2.96

Source: CORENADER

CORENADER has been attempting to secure a source of income since 2003 through commercial sales of seedlings and testing services<sup>18</sup>, and recorded 1 million pesos in sales for 2004. The agency plans to expand this to build its unique income source.

<sup>17</sup> This is a program that pays an incentive of 1 peso per surviving tree, divided into two payments a year, at different stages of the planted forest's growth.

<sup>18</sup> The research building located in the nursery conducts a variety of testing services, such as soil analysis.

## 2.5.2 Operation and Maintenance

CORENADER supervises operation of the nursery ground. Approximately 130 people are assigned as full-time staff underneath supervising directors for the 6 departments (seed gathering, seed selection, seedling production control, facility operation and maintenance, research center, and water management). During the peak seedling raising season as many as 130 residents from the local community are hired as part-time workers to perform seed selection and transplanting work. For the execution, operation and maintenance work of reforestation and forest road construction, staff of CORENADER is assigned to the various areas to provide guidance and supervision to the residents of the area who perform the operation and maintenance. For the reforestation operation and maintenance, CORENADER pays an incentive depending on the tree survival rate to increase awareness in preserving the forest at the local level and to support its formation of operation and maintenance capability. Since 1998, CORENADER has paid a total of 52.35 million pesos (approx. 530 million yen) in incentives to 28 communities.

Table 6. State of Participation in the Reforestation Project by Local Residents

During Project	Reforestation Work	No. of Participating Groups <sup>19</sup>	32
		No. of Participants	8,110
Project O&M	Incentive Program	Total Amount Paid (1,000 pesos)	52,350
		No. of Participating Groups	28
	Firefighting Activities	Total Number of People	10,163

In a questionnaire survey of program participants, the participants themselves indicated they were on the whole satisfied (92%) with the state of the reforestation activities in which they took part. Of those that responded there were problems with the state of maintenance, they mentioned the killing of trees by the setting of fires and pests and damage from drought.

In addition, the executing agency is also focusing on measures to prevent forest fires and has contracted with local residents to form a total of 43 firefighting squads, and 15 to 20 contract staff from each of these squads performs such activities as conducting

<sup>19</sup> Here, the regional cooperatives, such as Mexico's ejido and comunida are collectively called groups.

patrols and taking the first response when a fire breaks out.

Future operation and maintenance issues of CORENADER are (1) reviving forest lost in forest fires and (2) maintaining resident interest in the reforestation project after the incentive project period has ended. To resolve these issues, CORENADER is proceeding with reforestation to increase the reforested area by 1,072 ha and form a 140 km long windbreak by 2005. It is also implementing an incentive system for promoting agro-forestry<sup>20</sup> to increase awareness and involvement in forestry resources by local residents.

### 3. Feedback

#### 3.1 Lessons Learned

In this project, the payment of incentives increased the participation and awareness of the residents in the reforestation area. It is considered beneficial when implementing similar projects in the future to actively involve the residents in the target area from the project implementation stage through the use of an incentive program and other means.

#### Recommendations

(For Executing Agency)

Preventing forest fires is an important issue for improving the reforestation survival rate. Preventing the setting of fires to create grazing land, the main cause of forest fires, will require education<sup>21</sup> on systematic development of grazing land and other measures for ranchers, who are the ones setting the fires, to strengthen operation and maintenance while also preventing forest fires.

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<sup>20</sup> COREANDER is implementing the “Production Changeover Program” (2005-2008) to provide economic compensation for farmers who convert to agro-forestry until the agro-forestry approach becomes economically viable. Under this system, 500 ha of farmland has been converted by 2005.

<sup>21</sup> For example, the government can implement systematic land reclamation by selecting the timing and location that do not spread fires quickly and by providing pasture land to the local communities, or reduce illegal fires by teaching how to prevent fires from spreading.

### Comparison of Original and Actual Scope

Item	Plan	Actual
① Project Scope		
1) Nursery Ground	1) Nursery ground: Nursery building, germination house, equipment storehouse, training building, etc. Equipment procurement: Nursery pots, potting soil, fertilizer, small trucks, bulldozers, etc.	1) Nearly as planned
2) Reforestation Projects	2) Reforestation area: 55,600 ha (Number of transplanted trees 91 million) a) Mexico Federal Dist.: 26,600 ha b) State of Mexico: 18,837 ha c) State of Morelos: 10,163 ha	2) 32,676 ha (62.84 million trees) a) 32,676 ha b) Cancelled c) Cancelled
3) Forest road improvements	3) Total extension: 623 km a) Mexico Federal Dist.: 283 km b) State of Mexico: 240 km c). State of Morelos: 100 km	3) Total extension: 170.57 km a) 170.57 km b) Cancelled c) Cancelled
4) Other	4) Construction of fire watchtowers: 9 towers Repair of existing facilities: 4 facilities	4) As planned
② Construction Period	Jan. 1993 to Aug. 1999 (80 months)	Jan. 1993 to Feb. 2004 (134 months)

1) Nursery Planning Construction	1) 1993 Jan. 1993 to Jul. 1993 Sept. 1993 to May 1994	1) 1993 to 1997 Environmental Education Center Planning Jan. 1993 to Jul. 1993 Construction Jan. 1994 to May 1995 Nursery buildings Planning Jun. 1993 to Dec. 1993 Construction Oct. 1995 to Sept. 1997
2) Reforestation project Planning Reforestation	2) 1993 to 1999 (Jun.-Aug. each year) Jan. 1993 to May 1993 1993 to 1999	2) 1998 to 2003 (Jul. to Oct. each year) Jan. 1994 to May 1994 1998 to 2003
3) Forest road improvements Planning Construction	3) 1993 to 1999 1993 to 1998 (Oct.-Nov. each year) 199 to 1999	3) 1996 to 2003 1996 to 2003 (for 2 months each year) a. Nov. 1998 to Mar. 1999 b. Sept. 2001 to Dec. 2002
4) Consulting services	4) Jan. 1993 to Dec. 1999	4) Mar. 1993 to Dec. 2003
③ Project Cost	17,339 million yen	18,235 million yen
Foreign currency	9,433 million yen	7,945 million yen
Local currency	7,906 million yen (Local currency: peso)	10,290 million yen (Local currency: peso)
Total	17,339 million yen	18,235 million yen
ODA Loan Portion	10,403 million yen	7,945 million yen
Exchange rate	1MXN = 41.37 yen (April 1992)	1MXN = 13.14 yen (December 2003)