People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan

"Hubei Province Afforestation Project"

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0. Summary

The Hubei Province Afforestation Project (hereinafter referred to as the "Project") aims to improve the quality of forests in Hubei Province, and restore their multi-dimensional functions by afforestation and Mountain Closure. The Project was prompted by the increase in the importance of afforestation because of the escalation of flood damage in the Yangtze River basin area. The Project's relevance is high because its aim is consistent with the Chinese Government's development policies, development needs and Japan's aid policy. Affected by the Forest Tenure Reform[1], the main project implementation body was changed from small-scale to large-scale farmers. The change was a positive one for assuring forestation and for setting the sustainable system for forest management while benefitting the small-scale farmers. In contrast, a problem at the time of the appraisal is that erosion control effects by forest type were not examined. However, the problem is not taken into consideration for the relevance rating because, regardless of the forest type, a certain amount of ecological conservation effects exist, and the risk of a significant decrease in the Project's sustainability is low.

The Project's afforestation area exceeded the annual area of water and soil erosion control of Hubei Province, and contributed to improving the forest coverage ratio and the forest stock volume[2]. The forests are growing, and future economic impacts are expected. However, since tree plantation and management did not follow the afforestation plan, most of the forests became simple forests and a delay in tree growth was observed. Consequently, the effects on forest quality improvement and ecological conservation are limited. Thus the effectiveness and impact of the Project are fair. With regard to efficiency, although the cost of the Project was within the planned limit, the Project period was longer than planned because of the supplemental planting and additional forest building. Thus the efficiency of the Project is fair. There was no major change in the Project's executing agency, and the funds for the operation and management were secured by subsidies and the forestry bureau's budget. However, three years after the planting, forests were not maintained properly because of the rising employment costs and lack of relevant knowledge. It is necessary to upgrade technology on forestation, nursing, and thinning among engineers and farmers and disseminate accurate knowledge to them. The sustainability of the Project is fair because a few problems were observed in technical and project implementation bodies' financial aspects and the maintenance status.

[1] The Forest Tenure Reform was meant to allocate ownership of forest lands to individual farm households. In Hubei Province, the reform was launched in 2006, and completed in 98% of the relevant area by 2011.

[2] The forest stock volume is an indicator to measure the quantity of a forest by cubic volume of the timbers in the forest. It shows the status of a forest per unit area.

In light of the above, the Project is evaluated to be partially satisfactory.

1. Project Description

Project Site

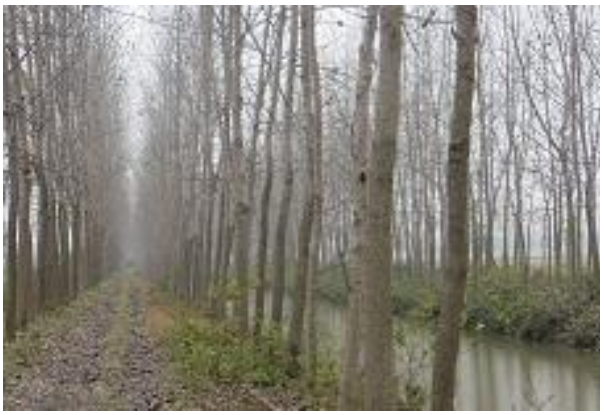

Photo 1: Protection forest build on the riverbank (Hubei Province Jianli County)

1.1. Background

Since 1949, afforestation has been one of the main policies of the Government of China. The major deforestation to meet the demand for timbers due to the economic growth led to the deterioration of the quality of forestry resources, an increase in the damages of natural disasters such as floods, the degradation in the natural environment, and the rural poverty due to lower productivity in cultivated and pasture lands. After the devastating flood in 1998, the Government implemented the National Plan for Ecological Construction. The plan set prioritized programs for natural environment improvement, their target areas and quantitative goals, and launched large-scale afforestation projects. Hubei Province was a part of the target area of the Yangtze River Basin Shelter Forest Program. At the time of the appraisal, the forest coverage ratio in Hubei Province was about 30%, which was higher than the national average of 17%. However, the quality of the forests in the province deteriorated because they were not maintained properly. The erosion area amounted to one-third of the province. The drained soil that raised the river bed also exacerbated the damages by floods and other natural disasters. Under such circumstances, the Hubei provincial government requested the Government of Japan for an afforestation project to recover the multi-dimensional functions of forests such as ecological conservation and water and soil erosion control. The Government of Japan approved the request as a yen-loan project.

1.2. Project Outline

The objective of the Project is to increase the forest coverage ratio and enrich forest resources by afforestation and Mountain Closure[3], thereby contributing to restoring the multi-dimensional functions of forests such as ecological conservation and erosion control in

[3] Mountain Closure is a measure to promote natural growth of trees and vegetation in the area by prohibiting the entry of people and livestock.

Hubei Province.

Loan Approved Amount/ Disbursed Amount	7,536 million yen / 7,484 million yen	
Exchange of Notes Date/ Loan Agreement Signing Date	March 2004/ March 2004	
Terms and Conditions	Interest Rate	0.75%
	Repayment Period (Grace Period)	30 years (10 years)
	Conditions for Procurement:	General Untied
Borrower / Executing Agency	Government of People's Republic of China/ Hubei Province People's Government	
Final Disbursement Date	October 2012 (original date: October 2011)	
Main Contractor (Over 1 billion yen)	None	
Main Consultant (Over 100 million yen)	None	
Feasibility Studies, etc.	"Feasibility Study Report" Forestry Prospect and Design Institute of Hubei Province, June 2003	
Related Projects	● Gansu Afforestation and Vegetation Cover Project (L/A 2003) ● Jiangxi Province Afforestation Project (L/A 2004) ● The Japan-China Cooperation Science and Technology Center for Forest Tree Improvement Project (Technical Cooperation 2001–2006) ● Forestry Development in Poor Areas Project (World Bank 1999–2005) ● Afforestation Project I-IV (World Bank 1990–2009) ● Sino-German Cooperated Afforestation Project (German Government 2005–2012)	

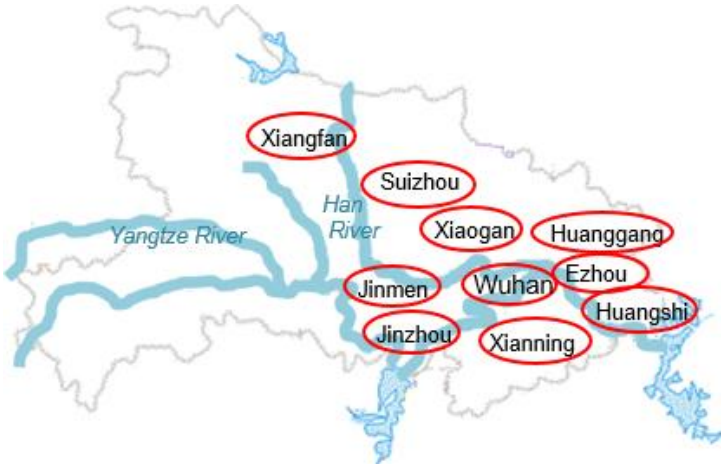

Figure 1: Location of the 10 Project Cities and the Major Rivers

2. Outline of the Evaluation Study

2.1. External Evaluator

Shima HAYASE, IC Net Limited

Yuko KISHINO, IC Net Limited

2.2. Duration of Evaluation Study

The ex-post evaluation study was carried out as follows:

Duration of the Study: August, 2014 – November, 2015

Duration of the Field Study:

1st Field Study: November 23, 2014 – December 4, 2014

2nd Field Study: April 20, 2015 – April 24, 2015

2.3. Constraints during the Evaluation Study

As this ex-post evaluation was carried out two years after the project completion, it was premature to observe the Project's mid- to long-term effects and to analyze future prospects conclusively. Accordingly, the ex-post evaluation focused on analyzing basic effect indicators, prospects for the development and sustainability of the Project's effects, and the status of the institutional, financial and technical environments to realize the prospects. Also, because of the following constraining factors, the Project's effectiveness had to be provisionally evaluated by using the sampling data collected through the field survey[4]. Firstly, the forests were still growing and not ready for an observation of their fully developed status. Secondly, the Project covered a vast area consisting of 37 counties, and it was impossible to visit all the project sites within the allocated study period. Moreover, the survival rate, i.e., the main operational indicator, was not measured by the method agreed at the time of the appraisal. Thus the evaluation team did not compare the target figure and the actual one provided by the provincial government, but made a judgment based on the results of the field survey.

3. Results of the Evaluation (Overall Rating: C[5])

3.1. Relevance (Rating: ③[6])

3.1.1 Relevance to the Development Plan of China

(1) Development Policy at the Time of the Appraisal

At the time of the appraisal, in the National Plan for Ecological Construction

[4] The Project was implemented in 37 counties, which is a vast area. It was impossible to conduct a field study in all the counties during the evaluation study period. To address this problem, the evaluation team asked the Hubei Province People's Government, the executing agency, to collect operation and effect indicators in all the counties. In addition, the evaluation team chose six representative counties to conduct questionnaire, site-visit, and beneficiary surveys in order to grasp the overall picture. The first field study did not capture information on the southwest area. Thus, in the second field study, the evaluation team visited two additional counties in the area.

[5] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[6] ③: High, ② Fair, ① Low

(1998–2050), the Government of China set four target areas for natural environment protection and restoration. Hubei Province was included in the Yangtze River Basin area where soil loss reduction and afforestation were the priorities.

(2) Development Policy at the Time of the Ex-post Evaluation

Under the 12th Five-Year Plan (2011–2015), Hubei Province was a target area of the Yangtze River Basin Shelter Forest Program to reduce soil loss, the Natural Forest Resource Protection Program, and the Steep Farmland Conversion to Forestland. The Hubei Province 12th Five-Year Plan (2011–2015) also set the policies to protect natural forests, to promote afforestation and reforestation by converting steep-farmlands to forests, and to encourage tree planting in mountains and fields, and reduce erosion. At the same time, the province aimed to promote economic effects by using forest resources. To implement the policies, the Hubei provincial government encouraged the use of foreign loans. Since the 1990s, the government has executed afforestation projects funded by the World Bank and the Government of Japan. A large-scale project is needed to attain the policies' goals in a vast area. As shown in Table 1, the Project is larger in both the afforestation area and the budget than other projects implemented around the same period, and thus the implementation of the Project is relevant.

Table 1: Foreign Funded Afforestation Projects

Project	Donor	Duration (year)	Afforestation Area（ha）	Cost (10,000 yuan)
Forestry Development in Poor Areas Project	World Bank	1999-2005	52,885	23,919
Afforestation Project IV	World Bank	2003-2009	13,782	5,492
Sino-German Cooperated Afforestation Project	German Government	2005-2012	12,000	12,000
This Project	Japan	2004-2012	313,378	78,175

Source: Hubei Province Forestry Bureau Foreign Fund Afforestation Project Office
Note: The Project's cost was calculated by applying the following exchange rate provided by the Hubei provincial government: 1 yuan = 13.8343 yen (average rate from 2004 to 2013).

3.1.2 Relevance to the Development Needs of China

(1) Relevance to the Development Needs at the Time of the Appraisal

At the time of the appraisal, forests in Hubei Province were not maintained properly, and their quality deteriorated. The average forest stock volume in Hubei Province was 33.1m^2/ha, which was far below the national average of 83.9 m^2/ha. Thus the forests did not fully perform their multi-dimensional functions such as retention of water and soil. It is estimated that 1.4 hundred million tons of soil flows into Yangtze River annually. The soil inflow raised the river bed, and made the river basin vulnerable to natural disasters such as floods. It also caused the flood damage that cost more than 10 billion yen per year. The Hubei provincial government prioritized the improvement of the forest quality, and aimed to implement afforestation in a total area of 530,000 ha through the Hubei 10th

Five-Year Plan (2001–2005).

(2) Relevance to the Development Needs at the Time of the Ex-Post Evaluation

At the time of the ex-post evaluation, the average forest stock volume in Hubei Province was 40.1 m^3/ha, which was still far below the national average of 70.2 m^3/ha[7]. The forest coverage ratio reached 38.4%, which is above the national average of 20.4%[8], and the forest area kept increasing. However, the forests' multi-dimensional functions such as water and soil retention were still at a low level because the forests consisted mostly of newly-planted young trees. According to the National Ministry of Water Resources, the water and soil erosion area in Hubei Province in 2010 reached nearly 55.8 thousand km^2, which is more than 30% of the provincial territory, and the annual erosion amount was 1.78 hundred million ton. Therefore the situation remained serious[9]. Out of the 2,466 thousand-ha crop-damaged area in the province, 1,999 thousand ha, more than 80% of the area, was damaged by erosion. The 12th Five-Year Plan (2011–2015) laid out the goals to increase the forest area to 7.6 million ha, the forest coverage ratio to 41%, and the forest stock volume to 47.4 m^3/ha by executing afforestation in an area of 461 thousand ha. Thus, at the time of the ex-post evaluation, the development needs for improving the forest quality were high.

3.1.3 Relevance to Japan's ODA Policy

Both the Economic Cooperation Plan for China issued by the Government of Japan in October 2001 and Japan's Medium-Term Strategy for Overseas Economic Cooperation Operations (2005–2008) gave priority to addressing global environmental issues, and cited the following means to do so: cooperation to environmental conservation, forest conservation and management. The Country Assistance Policy for China (2003) set its main targets as environmental conservation and human resource development in the inner part of China, because environmental problems in China might have a direct impact on Japan. The Project targeted afforestation in Hubei Province in inland China, and contributed to environmental conservation. Therefore its relevance to Japan's ODA policy is high.

3.1.4 Appropriateness of the Project Plan and Its Approach

The project's documents provided by JICA explained the Project was aiming for "restoration of forests' multi-dimensional functions," and the main effect of the Project as "ecological conservation and reduction of erosion[10]." By contrast, the draft project plan

[7] The stock volume at the time of the ex-post evaluation is lower than the one at the appraisal time. This is because the ratio of the area with growing trees became larger although afforestation projects increased the total forest area.
[8] 8th National Forestry Resource Census (2013)
[9] The water and soil erosion area was 60.8 thousand km^2, accounting for 32.7% of the province's area. The annual sediment yield volume was 2 hundred million ton.
[10] The Project's effect, "restoration of forests' multi-dimensional functions" was determined as ecological

prepared by the Chinese Government cited "social and economic effects by enriching forest resources," and expected that income earned from the forest resources would be a motivation for taking part in the Project and a funding source for forest management. The Government of Japan also recognized that, although the social and economic effects were not the main objective, the revenue from forests was a necessary resource to make the Project sustainable[11]. It is undeniable that the two sides' interpretations differed on the main effect of "restoration of forests' multi-dimensional functions." The difference became apparent after the Project commencement through the major modifications in the Project plan at the time of the appraisal and project approaches. The following are the modifications and their relevance.

(1) Substantial Change in the Project's Implementation Bodies

The Project planned to take the participatory approach in which small-scale farmers planted trees for improving the ecological environment of their farms and reducing poverty. Therefore, the participating farmers would have been to build a Protection Forest, an Economic Forest, would set a Mountain Closure area in their own lands[12], and would provide manpower for nursing and forest maintenance. They would have been also to earn income from the timber from thinning and forest products. In reality, a much smaller number of farmers took part in the Project, and the average afforestation per participant[13] became more than 10 times the planned one.

Table 2: Number of Participants and Afforestation Area for One Participant (Unit: ha)

	Plan (2004)				**Result (2012)**			
	Individual Farmer	Collective Farm	State Owned Forest Farm	**Total**	Individual Farmer	Collective Farm	State Owned Forest Farm[14]	**Total**
# of participant	185,305	3,576	231	189,112	15,599	252	76	15,927
Afforestation Area	157,397	86,816	46,066	290,281	177,596	76,722	59,059	313,378
Average afforestation area per participant	0.85	24.3	199.4	1.53	11.4	304.5	777.1	19.7

Source: Hubei Province Forestry Bureau Foreign Funds Afforestation Project Office
Note: The category, "Individual Farmer" includes individual farmers, associational-farms, and business enterprises.

conservation and reduction of erosion. According to the JICA documents, ecological conservation can be interpreted as "enrichment of forest resources and biodiversity by securing plant coverage." However, the Project's appraisal did not mention the development needs of "enrichment of forest resources and biodiversity," or any indicator for reduction of erosion. The JICA official in charge at the time of the appraisal said that the Project's main effect was determined as reduction of soil erosion.

[11] The project documents provided by JICA have no direct reference to what "social and economic effects by enriching forest resources" mean. The evaluation team confirmed the meaning of the term through an interview with the JICA official in charge.

[12] At the time of the appraisal, the planned average afforestation area per farm household was 0.85 ha.

[13] The actual average afforestation area per farm household was 11.4 ha.

[14] Mountain Closure is a method to restore plants and woods by restricting the entry of people or livestock in a forest. This method was applied only to state-owned forest farms that were for the public interest because it incurs a cost for management but earns no revenue.

The change was partly due to the Forest Tenure Reform that was implemented nationally after the start of the Project. The reform allocated forest tenure to individual farm households. Small-scale farmers who were allocated small areas chose one of the following options: taking part in the Project by organizing an association with other farmers; renting their lands to large-scale farmers or enterprises to earn rental fees; or providing manpower to earn wages.

The farmer or farm wishing to participate in the Project applied to their county forestry bureau and signed a loan agreement. Large-scale farmers, farmers belonging in associations, and enterprises became the main project implementation bodies because the bodies had to meet a few preconditions such as financial capability for maintaining forest lands and repaying loans.

Afforestation projects require inputs including materials for planting and maintenance costs before a forest is fully grown to generate sufficient income. Because of the change in the conditions of the loan agreement, the implementation bodies were able to manage with their own financial resources the entire process from leveling before planting, securing costs for management and repayment, and employing necessary manpower for forest management. Thus the change was a good choice for enhancing the Project's effects as well as securing the Project's financial sustainability. The change had no negative impact on social aspects because small-scale farmers became secondary beneficiaries by earning rental fees and labor wages.

(2) Appropriateness of Appraisal and Change by Project Purpose and Afforestation Method

The main objective of the Project was the improvement of the quality of forests through the effects of soil erosion reduction and ecological conservation. As explained in ①and ② below, JICA should have provided supervision and guidance to the Project through the executing agency on the following: whether the Project examined the appropriateness of the appraisal and change regarding afforestation methods, selection of tree species, and forest design based on differences in effects on the Project objectives. However, a certain amount of effects were realized in erosion reduction and ecological conservation regardless of afforestation methods, and the risk of significant deterioration was low in the sustainability of the Project's effects. Thus the points mentioned above were not taken into consideration in rating the relevance of the Project.

① Effects on Water and Soil Erosion Control

At the time of the appraisal, it was determined that erosion control effects yielded by afforestation were the same regardless of forest type (Protection Forest[15], Economic

[15] According to the Forestry Law of China (other definitions below are also based on the same law), Protection Forests include those for water conservation, water and soil retention, engineering sand fixation, farmland

Forest[16], Timber Forest[17], or Mountain Closure[18]). Based on the recognition above, the Project plan set afforestation methods and areas according to the Chinese needs. During the implementation of the Project, the executing agency requested to switch a few Economic Forests to protection ones. At that time, the difference on erosion control effect by afforestation method was not considered. In an afforestation project that aims to control soil erosion, the location of a Protection Forest shall be decided first depending on the needs to control soil erosion, and then the area of Economic and Timber Forests shall be decided according to the economic needs. The Project did not follow the procedure above and prioritized the needs of the Chinese side.

② Effects on Ecological Conservation

At the time of the appraisal, ecological conservation was defined as the enrichment of forest resources and biodiversity. The forest design of the project plan aimed to build mixed forests by planting multiple species. However, in reality, selection of type and species fell under the operation of the participants, they prioritized economic effects over ecological conservation. The forest inspection did not have criteria for if the participants successfully build mixed-forest as designed. As the result, majority of project sites, which supposed to be mixed forests, ended up to be simple forests. Simple forests do not help realize the intended biodiversity because they use a limited number of tree species. In addition, simple forests have low durability because they have a high chance of spreading the damage of diseases and pests to the same species and varieties. According to the Chinese forest sector expert, it is important to promote stable growth of trees in order to build and maintain quality forests, and a mixture of broad-leaf and needle-leafed trees are desirable for that purpose. The Project's contribution to improving the forest quality, as required in the development needs, was limited because most of the Protection Forests ended up being simple forests.

The Project has been highly relevant to the development policies and needs of the Chinese and Hubei Governments, and Japan's ODA policy. The appropriateness of the Project approach had a problem because the Project plan was designed at the time of the appraisal without considering differences in erosion control effects by forest type. However, regardless of the forest type, certain ecological effects observed, and this problem did not compromise the Project's relevance seriously. Therefore, it is fair to say that the relevance of the Project is high.

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protection, revetment forests, and roadside trees.

[16] Economic Forests are those that aim to produce fruits, oil, drinks, seasoning, industrial materials, and medicine.

[17] Timber Forests are mainly for timber production and include bamboo forests.

[18] Mountain Closure is a method to protect forests. According to the "Technical Regulations for Afforestation," the method is taken to restore the vegetation by half or fully blockading the target area, so to prohibit tree cutting for energy and livestock access.

3.2. **Efficiency (Rating: ②)**

3.2.1 Project Output

At the time of the appraisal, the Project's envisioned outputs consisted of afforestation, facilities and equipment, building the Training Center, and technical training. Table 3 shows the plans and results of the outputs of the Project.

Table 3 Output

Item	Plan (Target year 2009)	Result (Project completion 2012)
Afforestation	**290,281 ha**	**313,378 ha**
Economic Forest	20,903 ha	21,764 ha
Protection Forest	269,379 ha	291,614 ha
Protection Forest I	47,575 ha	49,716 ha
Protection Forest II	71,518 ha	88,902 ha
Mountain Closure	152,996 ha	152,996 ha
Afforestation Material		
Seedling and Plants	324.10 million	322.37 million
Fertilizer	29,003 ton	N/A
Pesticide	589 ton	N/A
Vehicle	3	As planned
Office Equipment	275 pieces	244 pieces
Environment Monitoring Tools	48 pieces	44 pieces
Training Center	2,000 m^2	2,171 m^2
Training for Managers/Engineers	N/A	618 persons
Technical Training for Farmers	90,422 persons	100,781 persons

Source: Hubei Province Forestry Bureau Foreign Funds Afforestation Project Office

(1) Scope of the Project

It had been planned to implement the Project in 10 cities and 37 counties. However, national afforestation projects started before the Project and used provisional forest lands for the Project. As a result, Xishui and Yingshan counties withdrew from the Project, and Songzi[19]city joined it. In addition, as a result of the further split of a few administrative divisions, 10 cities and 42 counties executed the Project. However, the scope of the Project as a whole remained unchanged.

(2) Forested Area

The actual afforestation area was 313,378 ha in total, which is 108% of the planned 290,281 ha. The area breakdown consisted of 21,764 ha of Economic Forests, and 291,614 ha of Protection Forests that amounted to 93% of the total area. Furthermore, the Protection Forests were made up of Protection Forest I (49,716 ha), Protection Forest II (88,902 ha), and Mountain Closure (152,996 ha). Protection Forest II occupied more than 90% of the area increased from the plan at the time of the appraisal.

[19] Songzi city is a county-level jurisdiction district.

The documents provided by JICA show no clear difference between Protection Forest I and II, and define them as the Ecological (Protection) Forests that aim to secure water and soil, conserve water sources, and protect farmlands. According to the interview with the provincial forestry bureau, Protection Forest I was to be conserved because it was planted near water sources for the public interest. By contrast, Protection Forest II was planted and maintained practically as a Timber Forest for logging and paying back debts. In addition, in Protection Forest II, since the implementation bodies were in charge of selecting forest type and tree species, economic effects were prioritized, and the area of practical Timber Forests increased. The Project was a participatory one financed by borrowings. However, the executing agency's involvement would have been necessary in finalizing forest type and species. The sections on effectiveness and sustainability will discuss the effects and influence on future forests caused by switching Ecological (Protection) Forests to Timber ones.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned project cost was 10,977 million yen in total (of which the ODA loan portion accounted for 7,536 million yen). The actual project cost was 10,815 million yen (of which the ODA loan portion was 7,484 million yen), which was 98.5% of the planned amount. In the planned project cost, the afforestation cost was to be 9,632 million yen. However, the actual afforestation cost was 10,027 million yen, i.e., 104% of the planned one. This was because the afforestation area increased to 108% of the plan. The labor cost, which was about 20 yuan per day at the time of the appraisal, increased to 100 to 120 yuan per day during the project period. However, the increase in the labor cost was partially canceled out by a decrease in the afforestation material cost, and the actual total labor cost was 104% of the planned one. At the time of the appraisal, the province was to purchase in bulk such afforestation materials as plants, seeds, fertilizer, and pesticide. However, bulk purchase turned out to be inefficient and costly. Accordingly, the Project decided to have each implementation body purchase fertilizer and pesticide from nearby venders depending on its needs and switch chemical fertilizer to organic one. Eventually, the province purchased only seedlings and seeds[20].

3.2.2.2 Project Period

Although the planned Project period at the time of the appraisal was 68 months from March 2004 to October 2009[21], the actual period was 92 months from March 2004 to March 2012, i.e., 135% of the planned one. The Project period was extended for the following reasons.

[20] The Hubei Province Forestry Bureau applied to the former JBIC for a budget change in September 2008, and JBIC approved the change.

[21] The following definition of the project completion was agreed upon: when the project area passes the third growth year inspection on the survival rate.

- In 2009, the originally planned project completion year, the afforestation area fulfilled the planned scope although supplemental planting continued in the areas that failed the inspection.
- Heavy snow in 2008[22] and drought in 2010[23] forced the Project to carry out supplemental planting in areas where young Chinese fir trees and bamboos were affected.
- The surplus from contingency and management fees was spent on build new forests by 2012 with the total area of 1,093 ha.

3.2.3 Economic Internal Rate of Return

At the time of the appraisal, the economic internal rate of return (EIRR) of the Project was not calculated because the main objective of the Project was to restore forests' multi-dimensional functions such as conserving the ecological environment and erosion control, and the method to calculate the EIRR in a way that suited the Project did not exist. This ex-post evaluation does not implement an analysis based on the EIRR because it was not calculated during the Project execution either.

As mentioned above, although the project cost was within the planned limit, the project period was longer than planned. Therefore, the efficiency of the Project is fair.

3.3. **Effectiveness**[24] **(Rating: ②)**

The main component of the Project was afforestation. Therefore, the Project's effectiveness was to be evaluated by the quantitative indicators set at the time of the appraisal, and by forest condition, forest coverage ratio, and stock volume, all of which were to be based on the field studies. The impact of the Project was to be evaluated based on the following elements: reduction of erosion and ecological conservation; and economic and social impacts that were to be the motivation for the implementation bodies to plant trees and maintain forests and secure sustainability, which can be categorized together as "restoration of the multi-dimensional functions of the forests." Incidentally, because training was not a main component of the Project, its effects were to be evaluated in the technical aspect of operation and maintenance in the section on sustainability, but not in the sections on effectiveness or impact.

[22] Heavy snow in 2008 damaged 2,290,000 ha of forests in Hubei province.
[23] Drought in 2010 damaged 2,314 ha of forests in 9 project counties.
[24] The rating for Effectiveness is to be made in consideration of Impact.

3.3.1 Quantitative Effects (Operation and Effect Indicators)

(1) Survival Rate, Preservation Rate[25], Forest Density[26]

The calculation methods differed between the targets for the survival rate[27], preservation rate[28], and forest density set at the time of the appraisal and the results[29] provided by the executing agency. Thus it was not possible to compare the targets with the results and use the comparison as an indicator of the effectiveness of the Project. However, the field study for this ex-post evaluation[30] revealed that, in forests five to eight years after planting, all the figures exceeded the standards for the third-year inspection, i.e., preservation ratio of 85% for Economic Forests, 80% for Protection Forest[31], and forest density of 0.2 for Mountain Closure. The preservation ratio usually goes down as years pass after planting. However, the field study revealed a high preservation ratio in forests that were two to five years after planting. Therefore, based on the data from the field study, it is fair to say that the Project attained the targets in the survival rate, preservation rate, and forest density.

In the field study on Protection Forests (Chinese fir, pine), the evaluation team observed that forests were not planted as planned. The adequate plantation density was 167 plants/mu[32], but almost all Protection Forests' density was 197–400 plants/mu, which was too high. To confirm facts more in depth, the team interviewed engineers and managers of the county forestry bureau and the company that were responsible for on-site inspection. The provincial technical regulations set the formula for the survival and preservation rates as "ratio of the number of trees in the area to the number of trees planted," but the actual inspection used "ratio of the number of trees in the area to the prescribed number of trees to plant" for calculating the density.

Survival/Preservation Rate = # of trees in the area / # of trees planted x 100
Actual Calculation Method = # of trees in the area / prescribed # to plant x 100

[25] China's Forestry Law sets the following definitions: [Survival rate] number of survived trees divided by the number of planted trees at the first growth period; [Preservation rate] the equivalent value in the third growth period.
[26] The forest density measures the density of woods. "1" means that the forest is wholly covered with trees. "0" means that there is no tree at all.
[27] The target survival rate in the first growing period was 85% for both Protection and Economic Forests, and 95% for Timber Forests. No forest density target was set for Mountain Closure.
[28] The target survival rate in the third growing period was 80% for Protection, and 85% for Economic Forests and Timber Forests. The target forest density was 0.2 for Mountain Closure.
[29] Measures for inspection: The county forestry bureau inspected all the first and third growth-year forests. The bureau took 10% of the forests as samples, and assigned a private firm to inspect the samples further. The inspection records had no detailed measurement data, but listed only the achievement ratios, areas that passed the inspection, and the passing ratio. Thus the inspection records did not reveal the basis of the survival and preservation rates.
[30] Number of the planted trees was judged comprehensively by confirming the number of the planted trees to the implementation bodies in interviews, and observation the spaces in forests where died trees used to be planted.
[31] At one Protection Forest site (popular), the preservation rate was lower than the reference. It was because of the local damage from a tornado in the previous year. Thus as a whole, the Project attained the reference.
[32] Mu is a common Chinese unit of measure for land. 15 mu is equivalent to 1 ha.

Here is a hypothetical situation: in a forest where the technical regulation sets 167 as the appropriate number of trees, 200 trees are planted in the forest, and 160 trees remain in the area at the time of the inspection. In a regulation-based calculation, the survival and preservation rates is 160/200 = 80%. In the calculation method employed by the actual inspection, the result is 160/167 = 95.8%. Because the forests passed the inspection by having more than the prescribed number of trees, many implementation bodies planted more trees in the forests, raised the forest density, and disturbed the growth of the trees. Such dense planting of trees became a cause of the deterioration in the forests' quality.

In addition, the inspection company stated in the interview that Mountain Closure was acceptable with the following conditions: ①forest patrol personnel are appointed, a patrol system exists, and signs to notify the Mountain Closure area are built; ②no damage to forests is incurred by people or livestock. Here is the reason that forest density was not applied in inspecting Mountain Closure: in Hubei province, forest density was higher than 0.5 to begin with before any measures including Mountain Closure were taken, and it was not a practical indicator to observe effects. Also, the measurement method varied depending on counties: some counties included shrub trees while others did not. Thus forest density itself is not a reliable resource of data.

3.3.2 Growth Status in the Project Sites

The evaluation team conducted a field study in 20 project sites in total in six counties. The sites included Economic Forests, Protection Forests, and Mountain Closures. The team examined forest design, maintenance status, and preservation rates for the planted trees. In addition, the team measured the height, circumference and other benchmarks to inspect the growth of the trees. The following is a summary of the study results. The details and measurement data of the study are mentioned in the attachment.

Photo 2: Economic Forest (Oiltea Camellia) planted on the steep ground where severely eroded. (Hubei Province, Tongcheng County)

Photo 3: Individual Farmer's forest where planting and thinning were not appropriately done. (Hubei Province, Gucheng County)

(1) Economic Forest (Species: Oil-tea Camellia, Walnut, Yellow Peach)

In all the species in Economic Forests, the preservation rate exceeded 95%. The heights, diameters, and base circumferences were normal for the tree age. The planted varieties were appropriate for the environment. No major damage by forest diseases or pests was observed. In all the sites, tree planting, fertilization, and maintenance were done properly.

(2) Protection Forest (Species: Slash Pine, Chinese Fir, Poplar, Bamboo)

The planted varieties were selected properly. The preservation rate of all the species exceeded the target rate of 80%. The project plan aimed to enrich biodiversity, and recommended making mixed forests by planting more than one species. However, all the 19 sites visited for the field study except one were simple forests[33]. The implementation bodies that took initiative in selecting varieties avoided mixed forests that cost more for planting and maintenance than simple forests. Needle-leaved trees were planted at 133% to 277% of the appropriate density, and no thinning was done. As a result, a negative impact was observed on the growth of tree diameter and stock volume. Forest beds were covered with weeds and shrub trees, and appropriate maintenance and nursing were not provided. Poplar trees grew well and were maintained properly. A few poplar forests had the preservation rate of 60% because of the damage from a tornado, but the other forests exceeded the standard preservation ratio of 80%. Bamboo forests were not thinned to the appropriate level, and did not grow enough to be cut and used as industrial materials.

(3) Mountain Closure

Forest density[34] improved from 0.2 to 0.6—0.7 after five years of Mountain Closure. Ecological effects such as reduction of water and soil erosion and enrichment of forest resources were also confirmed.

[33] The evaluation team confirmed the varieties planted at the sites by interviews to the implementation bodies and by viewing.

[34] Mountain Closure is a method to improve forest coverage ratio and increase ecological effects such as reducing water and soil erosion and increasing forestry resources. Forest density is used to measure the difference between the original status and the growth one after the Project.

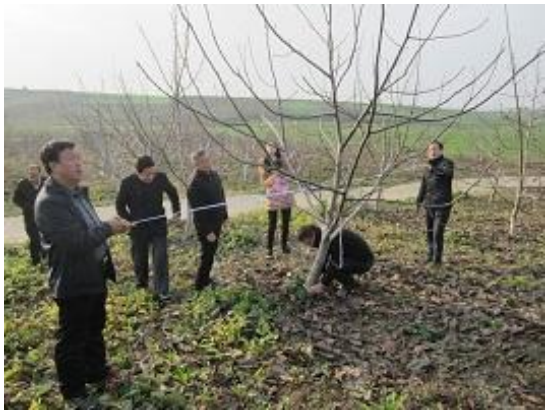

Photo 4 :Confirming growth situation at a project site. (Hubei Province, Laohekou city)

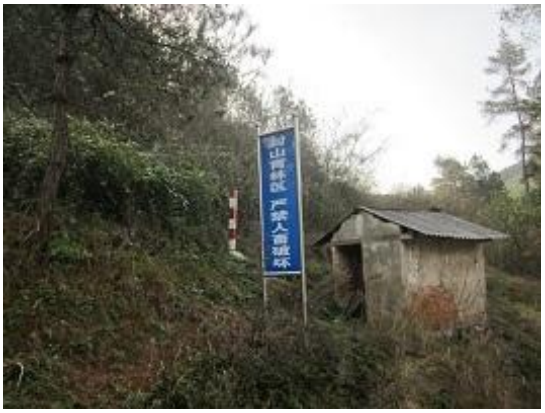

Photo 5: A sign to notify entrée limitation for Mountain Closure. (Hubei Province, Gucheng county)

3.3.3 Forest Coverage Ratio and Stock Volume

As shown in Table 4, all the province, and project counties and sites achieved the targets in the forest coverage ratio. Regarding the stock volume, no target was set, but in comparison to the baseline figure at the time of the appraisal, the results in both the province and project counties exceeded 158% as shown in Table 5. Thus it is fair to say that the intended project effect was attained.

Table 4: Forest Coverage Ratio

	Baseline	**Target**	**Result**
	Appraisal (1998)	One year after Completion (2010)	One year after Completion (2013)
Province	32 %	35 %	38.4 %
Project Counties	33 %	37 %	37.6 %
Project Sites	—	Increase 2.3 %	Increase 3.18 %

Sources: Target figure referred to JICA document at appraisal, Hubei Province Forestry Bureau Foreign Funds Afforestation Project Office provided the result
Note 1: Forest coverage ratio: Forest area for the total area
Note 2: Project site Forest coverage ratio: Ratio of forestry area passed the Project's inspection/area of the administrative area×100

Table 5: Stock Volume[35]

	Baseline	**Target**	**Result**
	Appraisal (1999)	One year after Completion (2010)	One year after Completion (2013)
Province	132.3 million m^3	N/A	209.4 million m^3
Project Counties	0.669 million m^3	N/A	1.06 million m^3

Sources: Target figure referred to JICA document at appraisal, Hubei Province Forestry Bureau Foreign Funds Afforestation Project Office provided the result

[35] The JICA appraisal documents listed the target figures in Project sites but did not describe the basis for calculating them. Thus in the ex-post evaluation, the evaluation team removed the figures from the indicators to analyze the Project's effectiveness.

3.4. **Impacts**

3.4.1 Contribution to Erosion Reduction

As shown in Table 6, in Hubei Province, erosion control measures were implemented in nearly 200 thousand ha per year. The measures included biological methods such as afforestation and Mountain Closure, and construction works on riverbank reinforcement. Table 7 shows that the water and soil loss area in Hubei Province was on the decreasing trend: 6.08 million ha in 2005, 5.58 million ha in 2010, and 3.69 million ha in 2013. Table 8 indicates that, in Chibi City, a field study site, both the sediment yield and the water and soil erosion area decreased year by year from 2003. Among the 73 water and soil erosion monitoring stations in the province, three are located in the project area. As shown in Table 9, the soil erosion amount decreased every year in all the three stations. The afforestation area of the Project between 2004 and 2010 was 310 thousand ha, which greatly exceeded the annual water and soil control measure area by the province. Thus it is fair to say that the Project contributed significantly to water and soil erosion control.

Table 6: Water and Soil Erosion Control Measured Area in Hubei Province

Hubei Province	W&S Erosion Control project Area (thousand ha/year)
2009	206
2010	225
2011	215

Source: Hubei Provincial Department of Water Resources, Soil and Water Conservation Gazette

Table 7: Sediment Yield and Water and Soil Erosion Area in Hubei Province

Hubei Province	Sediment Yield (million ton / year)	W&S Erosion Area (million ha / year)
2005	200	6.08
2010	178	5.58
2013	N/A	3.69

Source: Hubei Provincial Department of Water Resources, Soil and Water Conservation Gazette

Table 8: Sediment Yield and Water and Soil Erosion Area in Chibi City

Chibi City	Sediment Yield (10 thousand ton /year)	Ratio to 2003	W&S Erosion Area (10 thousand ha/ year)	Ratio to 2003
2003	292	100 %	10.3	100 %
2010	269.3	92.2 %	9.6	93.0 %
2011	263	90.1 %	9.58	92.9 %
2012	261	89.4 %	9.34	90.5 %
2013	248	84.9 %	8.16	79.1 %

Source: Documents provided by Chibi City

Table 9: Sediment Yield at Monitoring Stations (Unit: kg/ha)

Name of Location (tree species)	Songzi City (Pine tree)	Macheng city (Chestnuts)	Guangshui city (Jujube)
2006	5,434.3	2,949.2	3,416.2
2007	5,192.9	2,782.3	3,297.7
2008	3,716	2,621.2	3,139.7
2009	2,775.8	2,492	2,941.5
2010	2,075.8	2,193	1,941.5

Source: Hubei Province Forestry Bureau Foreign Funds Afforestation Project Office

3.4.2 Contribution to Ecological Conservation

In the project plan at the time of the appraisal, enrichment of forest resources and biodiversity was the expected impact on ecological conservation. Regarding enrichment of forest resources, no logging was done because the forests were not fully grown by the time of the ex-post evaluation. In the future, a drastic ecological change may occur if the Protection Forests are logged in a wide area. However, the risks that forest resources will be lost by excessive logging are low because of the existence of the logging quantity limits and permit system in accordance with the governmental logging plan.

With regard to enrichment of biodiversity, to achieve diversity of species by afforestation, the plan at the time of the appraisal recommended building mixed forests with about 40 species. However, the diversity ended up being limited because the selection of species was left to the implementation bodies: the planted species were about 10 kinds including pine, Chinese fir, poplar, camphor, bamboo, and oil-tea camellia. The field study revealed a few mixed forests of pine and liquidambar planted in a Chinese fir forest for fire control. However, almost all the forests were simple forests. If forest diseases or pests occur in simple forests, risks of spreading the damage to the same species and varieties are high.

In interviews, both the provincial forest bureau and the six counties targeted in the on-site field study stated that the Project helped enrich the diversity of animals and plants, but cited no specific data or species.

3.4.3 Economic and Social Impact by Afforestation

(1) Economic Impact by Afforestation

In the beneficiary survey[36] as shown in Table 10 to the question comparing the income from the forests before and after the Project, 86% of the respondents answered “Income increased.” To the question on the comparison of their income and expenditure, 47% answered “expenditure exceeded the income.” Thus the answers indicate that the

[36] The beneficiary survey was conducted on 100 project participating farmers in the six target counties of the field study. The questionnaire included questions on such matters as motive to participate in afforestation, project implementation status, status of training and technical guidance, income and expenditure for afforestation, status of debt payment, and level of satisfaction with the Project. The county government took samples from the county’s participant list, but the respondents were limited to the farmers who were able to come to the local county office on the day of the survey. While 15,599 farmers took part in the Project, this evaluation study collected 100 replies. The beneficiary survey results do not represent all the beneficiaries because the sample size was small, but the evaluation team used the results to analyze the tendency of the sample sites.

participants increased their forest area and production scale. About half of the participants' expenditure exceeded their income because the cost for forest maintenance including labor cost and material raised, repayment has started, and most of the Project's Economic Forests had not reached the tree age for stable production and would take more years until they are ready for logging. According to the interviews in the field study, the farmers who did not have stable income from the forests covered the maintenance costs from their other revenue. They considered the maintenance costs for future investment. Table 11 shows the prospective expenditure and income. In the future, the participants' income would exceed their expenditure; they would gain expected income from Economic Forests in five to ten years, and from Protection Forests in 20 to 30 years. Thus the Project is expected to have an economic impact.

Table 10: Result of the Beneficiary Survey (100 samples)

Has your income increased since the Project started?	
Income increased significantly.	13 %
Income increased in some extent.	73 %
No change.	6 %
Income did not increased much.	6 %
Income did not increased at all.	2 %
Are you earning or spending more for the Project's forest?	
Income is more than Expenditure.	50 %
Income and Expenditure are about the same.	3 %
Expenditure is more than Income.	47 %

Table 11: Maintenance Cost and Expected Income (Unit: yuan / mu)

Species	Afforestation	Maintenance	Expected Income	Net Income
Chinese Fir	1,500	4,900	13,000	6,600
Popular	300	1.500	6,000	4,200
Oil-tea Camellia	2,500	800/year	2,400/year	1,600/year

Source: interviews at the project sites

(2) Social Impacts from Afforestation

As stated in the section on relevance, small-scale farmers who had been expected to be the main implementation bodies at the time of the appraisal did not participate in the Project, but large-scale farmers, collective forest farms, and private firms did. The small-scale farmers chose to participate in the Project by renting their forest tenure to the implementation bodies or providing labor for wages. They became the indirect beneficiaries of the Project. In addition, in selecting project sites, the province gave priority to counties with mountainous terrains and poor population[37] and those with a large population of ethnic minorities. It is thus assumed that expected social impacts from the Project materialized.

[37] A poverty county is defined as one that average household income is less than 3,000 yuan.

3.4.4 Other Impacts

(1) Impacts on the Natural Environment

No negative impact on the natural environment has been found. This is partly a result of careful consideration and measures by the Provincial Forestry Bureau. To avoid a negative impact on the environment, the bureau prohibited mountain burning to protect indigenous vegetation when the implementation bodies planted new forests. Also for ground leveling, rather than removing all the plants, the bureau suggested leaving existing vegetation to the maximum possible extent, and planting new trees in pits dug for new planting.

(2) Land Acquisition and Resettlement

No land acquisition or resettlement occurred because the project implementation bodies were owners of the forest tenure. When large-scale farmers or companies rented forests from farmers, rental agreements were concluded based on the afforestation period and the current land price, and suitable rental fees were paid.

As mentioned above, the Project covered a larger area for afforestation than the one covered annually by the provincial water and soil control measures, and contributed to improving the forest coverage ratio and the stock volume. However, most of the forests ended up being simple forests, and their growth was behind schedule, because the plantation and management of forests were not executed as planned. Forest quality improvement and ecological conservation effects were limited. Therefore, the effectiveness and impact of the Project are fair.

3.5. **Sustainability (Rating: ②)**

3.5.1 Institutional Aspects of Operation and Maintenance

(1) Executing Agency

The Hubei Province Forestry Bureau Foreign Funds Afforestation Project Office[38] of the Forestry Bureau was responsible for supervising city and county project offices, and for managing funds for repayment. In addition, in cooperation with the bureau sections in charge of forest management and forest disease and pest control, the project Office operated and maintained forests.

The human resources of the 42 Project-participating counties' forestry bureaus and project offices increased from the time of the appraisal. The number of senior engineers increased substantially from 69 to 160, and the one of engineers from 549 to 2,082. The county forestry bureau was responsible for monitoring and supervising the forests after the completion of planting. At the township level, forest stations were managing the

[38] The project office is a generic term for administrative office.

forests.

Between at the time of the appraisal and the ex-post evaluation, no major change occurred in the institutional structure of the Provincial Forestry Bureau, the executing agency. The sections of the Bureau had a good partnership with the county bureaus, and the responsibilities of the sections were clearly defined. Therefore no problem was found in institutional aspects.

Table 12: Number of Human Resources in Forestry Bureaus and Project Offices of the Participated 42 Counties (unit: person)

	Forestry Bureau			Project Office		
	Total	Senior Engineer	Engineer	**Total**	Project Management	Finance
Plan (2003)	1,323	69	549	215	141	74
Actual at ex-post evaluation (2014)	2,494	160	2,082	220	144	75
Difference	189 %	232 %	379 %	102 %	102 %	101 %

Source: Hubei Province Forestry Bureau Foreign Funds Afforestation Project Office

(2) Implementation Bodies

In selecting implementation bodies, economic guarantees such as repayment capacity and collateral were requirements.[39] Thus large-scale farmers, collective farms, and firms with economic capacity became implementation bodies of the Project. The project plan at the time of the appraisal expected that the implementation bodies would provide manpower to maintain the forests. However, the implementation bodies employed necessary workers for operation and maintenance of forests because the scale of afforestation became larger than planned.

The implementation bodies were in charge of the maintenance of forests. They hired forest protection patrol for preventing fires and controlling diseases and pests. For tree planting and forest maintenance, the implementation bodies hired neighboring farmers. Labor shortage was observed in a few large-scale Economic Forests because farmers chose to work in distant locations for higher pay or prioritized work in their own farm in a busy farming season.

Between at the time of the appraisal and the ex-post evaluation, the executing agency and its subordinating bodies had good coordination, and defined their scope of work and responsibilities clearly. Also, implementation bodies with economic resources managed the Project in a well-organized fashion. Therefore no problem was found in institutional aspects of the operation and maintenance of the Project.

[39] Project implementation bodies such as farmers, collective forest farms, and state-owned forest farms had to meet a few conditions. Although the conditions varied somewhat depending on the county, they were essentially as follows: (1) The implementation body owns land for afforestation (in Gucheng county, land of more than 100 mu, i.e., 6.7 ha, was required); (2) The implementation body can repay debts; and (3) The implementation body has a collateral such as forest tenure certificate, land, building, property, and salary from a farm.

3.5.2 Technical Aspects of Operation and Maintenance

Training for engineers, whose mandate was to provide technical training and guidance to the implementation bodies, was conducted to those of the provincial, county, township, and state-owned forest farms. The survey to the trained engineers[40], as shown in Table 13, indicates that more than half of the engineers took the courses on afforestation techniques, forest design, nursery and forest protection, and project management. In contrast, 34% took the course on thinning techniques, and 15% the course on forest products utilization. Thus not many engineers took these two courses. The total number of engineers who took part in the training was 198, which was less than 10% of those of counties and state-owned forest farms. In addition, the field study revealed that trees in most of the Protection Forests were not thinned as planned. It is reasonable to conclude that lack of training of the engineers caused lack of dissemination of relevant knowledge to the implementation bodies.

Table 13: Result of Engineer Training Attendants Survey（47 samples）

What subject(s) did you learn at the training(s)?	
Afforestation Technique	79 %
Forest Design	66 %
Nursery	66 %
Forest Protection	62 %
Project Management	55 %
Financial Management	40 %
Forest Thinning Technique	34 %
Forestry Products Utilization	15 %

Training to the implementation bodies was carried out for 96,548 farmers, 3,048 collective-farm forest workers, and 1,185 state-owned forest farm employees. As shown in Table 14, the beneficiary survey revealed that 99% of the respondents took the course on afforestation techniques. More than half the respondents took most of the other subjects, but only 27% took the course on forest products and thinning-cut sales. The training was held just before planting, and the implementation bodies may have had little interest in thinning and forest products at the time because thinning and production would take five years or more after plantation. In addition, only 22 % of the respondents credited the training with any practical benefit. Thus it is fair to say that the training was not particularly useful.

[40] The questionnaire survey was carried out in the six counties that the evaluating team visited for the field survey. Forty-seven engineers who took part in the Project's training answered questions on the content, timing, duration, and number of training courses, and the effects of the training.

Table 14: Result of the Beneficiary Survey on Technical Training (100 samples)

What subject(s) did you learn from the training?		How the training affected to your afforestation skills?	
Afforestation technique	99 %	Afforestation technique improved	99 %
Seedling and plants handling	89 %	Seedling and plants handled appropriately	71 %
Forestry diseases and pests prevention	94 %	Prevented and cured forest diseases and pests	92 %
Fertilizer usage	83 %	Fertilizer used appropriately	88 %
Forest management	89 %	Managed forest appropriately	89 %
Funds management	56 %	Managed funds appropriately	45 %
Products and thinning cut sales	27 %	Sold products and thinning cut appropriately	22 %
		Motived to improve afforestation technique	86 %

Technical guidance at project sites was provided by engineers of the county and township forestry bureaus. As shown in Table 15, all the respondents to the beneficiary survey replied that they received technical guidance at least once. Among the respondents, 45% replied that they received technical guidance more than 10 times.

Table 15: Result of the Beneficiary Survey on Technical Training (100 samples)

How many times have you received Technical Training?	
Once	1 %
Twice to Three times	24 %
Four to Six times	24 %
Seven to Nine times	6 %
More than 10 times	45 %

According to interviews in the field study, training and technical guidance were provided before planting and until the inspection at the end of the third growth year of forests, but were hardly done afterwards. As a result, the implementation bodies had poor knowledge and practice on maintaining young growing forests, thinning, and selling forest products. Not only farmers but also local engineers had a scientific misconception that dense plantation was effective in raising the preservation rate and stock volume. The timing of the ex-post evaluation was also the time when the forests needed thinning. Thus it would be desirable to implement additional training to cover subjects that engineers and farmers need to be familiar with.

Regarding responses to emergencies such as forest fire, state-owned forest farms prepared patrolling shifts and manuals. From the viewpoint of forest protection, the state farms are also prepared to respond to a fire in neighboring farmers' forests. Farmers employed their own forest patrol, but had no manual or maintenance reports.

The implementation bodies were lacking in accurate knowledge and practice on maintaining young growing forests, thinning, and selling forest products. Not only farmers but also local engineers had a scientific misconception that dense plantation was effective in raising the preservation rate and stock volume. Thus the technical sustainability of the Project faces a few problems, and additional training and technical guidance are needed.

3.5.3 Financial Aspects of Operation and Maintenance

According to the provincial forestry bureau's project office, a budget was prepared for planting in all the available forests in the three years between 2014 and 2016 at the annual amount of 130,000 yuan/ha. Funding for forestry increased year by year. In 2011, the forestry budget was four times the one in 2005. The budget covered national programs such as the Program of Converting Steep-Farmland Back to Forest, the Natural Forest Resource Protection Program, and the Schistosomiases Prevention Forest Program, and subsidies for afforestation and nursing. The provincial bureaus in charge undertook forest maintenance, fire protection, and disease and pest control, and secured necessary budgets. The budget at the county bureau level was distributed from the province based on the needs, and the necessary amount was secured every year.

Table 16: Annual Funding for Forestry and the Sources (unit: 10,000 yuan)

Year	Annual Funding	State Budget	Domestic Loans	Bonds	Foreign Investment	Self-raising funds	Other Funds
2005	101,807	61,232	2,100	0	810	17,989	17,727
2006	143,784	98,498	682	0	6,467	24,645	12,787
2007	152,764	100,421	1,175	0	9,775	28,729	12,051
2008	195,895	142,573	500	0	2,515	23,794	24,645
2009	262,951	193,382	0	0	3,191	25,502	40,976
2010	280,082	207,950	16,000	0	1,604	14,406	40,122
2011	406,034	270,000	2,579	0	2,524	67,100	63,831

Source: National Bureau of Statistics of China Statistical Yearbook

Meanwhile, there were a few challenges. For the funding source of forest maintenance, state-owned forest farms and collective forest farms depended on their operating profit, and farmers relied on their independent revenue. At the time of the ex-post evaluation, neither Economic nor Protection Forests were at the tree age to generate a sufficient amount of income. Thus maintenance costs including labor costs and repayment that started in 2013 were covered by income from selling farm products or other businesses. Regarding forest products whose production was increased based on the national policy, there are risks that their prices may fall drastically because of overproduction. The businesses of the implementation bodies varied widely: they included poultry and hog farms, and businesses outside agriculture and forestry industry such as karaoke shops, hotel management, an advertising agency in Shanghai, and a brick factory. The Project's financial sustainability may affected by those businesses' success and failure.

In the field study, the evaluation team found that thinning and nursing of Protection Forests were not executed in proper frequency because of the higher maintenance costs caused by increased labor wages and labor shortage in farms. While similar problems were common in all of China, the national government launched the Young Forest Nursing Project in 2014 to provide a subsidy of 100 yuan/mu to Ecological Forests more than three years after planting. If a forest were covered by the subsidy, thinning and nursing would be promoted. However, the subsidy was not used much in the Project because the area of Ecological Forests

to be covered was limited and Timber and Economic Forests were not eligible for the subsidy.

The Project expected that revenue from forests would cover the costs for maintaining them and did not expect any shortage of funds. At the time of project planning, it was necessary to consider the maintenance costs based on necessary maintenance tasks, and examine prospects after the completion of the Project in accordance with the governmental policies and the availability of subsidies.

Table 17: Loan and Repayment Status (average of the respondent)

Total Loaned Amount	Rate	Starting date for Repayment	Amount Repaid
149,690 yuan	0.75 %	March 2013	11,036 yuan

Source: Beneficiary Survey

At the time of the ex-post evaluation, repayment for one-year (twice) was completed. The average amount per repayment was 5,518 yuan, and problems such as delinquency or insolvency have not occurred. If implementation bodies were unable to pay back the loan, the county (or city or districts) forestry bureau would shoulder the repayment. Therefore no problem was found.

Although income from the forest for future is expected, the implementation bodies cover the operation and maintenance costs with their revenues from businesses other than the forests. The failure of those businesses could negatively affect the financial sustainability of the Project. Because of the insufficiency of income from the forests, problems that tree thinning and nursing were not done properly were observed at the time of ex-post evaluation. Accordingly, the financial sustainability of the Project has a few problems.

3.5.4 Current Status of Operation and Maintenance

As mentioned in the effectiveness section, at the time of ex-post evaluation, the evaluation team observed that trees were not planted in the planned density or mixed, nor necessary nursing or maintenance executed in many forests. In this section, the recognition of the engineers who are responsible for monitoring the forests and provide guidance, and the one of the implementation bodies who are responsible for the operation and maintenance, are to be analyzed. The purpose of the analysis is to find if the forests built by the Project are to be operated and maintained sustainably.

(1) Operation and Maintenance of Forests

According to an interview with the provincial forestry bureau, no problem was found in the condition of forests in the 42 counties (cities, districts), but a few maintenance problems were found in 13 counties. The problems were caused by delays in recovery from natural disasters and damage from forest fires. In the beneficiary survey, 12% of the respondents said “There are some problems” in the maintenance situation of their forests.

They said that the problems pertained to “shortage of manpower” and “shortage of maintenance budgets.”

Table 18: Result of Beneficiary Survey on Forest Maintenance (100 samples)

How is the maintenance condition of the Forest?	
Fine	85 %
There a few problems.	12 %
There are many problems.	0 %
Not answered.	3 %

In the six counties targeted in the field study, Economic Forests were maintained well. Poplar Protection Forests were appropriately maintained as necessary tasks such as weeding, removal of shrub trees, and fertilizing were performed. However, in needle-leaved tree forest sites, maintenance tasks such as weeding and shrub tree removal were not done sufficiently. In the Chinese fir forests between the 8^{th} and 10^{th} growth year in particular, the forest density was 0.8 or higher, requiring immediate thinning.

Farmers did not undertake thinning to maintain the forest density at a proper level because of a misconception that dense planting would increase the preservation ratio and raise income by yielding more trees for thinning. Another reason for the failure to perform thinning was that, because of the increase in labor wages, employment costs and revenues from selling timber from thinned were about the same and no profit could be expected.

Accordingly, for proper operation and maintenance of forests, it will be necessary to provide additional training to forestry engineers and farmers to improve their techniques on afforestation, nursing, and thinning, and disseminate accurate knowledge among them.

(2) Sustainability of the Project’s Effects in the Long Term

In the long term, Mountain Closure and Economic Forests stay in the forests, and their erosion reduction effects will be preserved. However, if Protection Forests are cut, their erosion reduction effects will decrease. According to a JICA staff member at the appraisal screening, erosion reduction effects were considered to be the same regardless of the type of forest or species, and as long as the forests had some vegetation, no problem would occur on the erosion reduction effects.

In normal forest management techniques, deliberate afforestation is implemented in parallel to a logging plan. If deliberate logging and afforestation are not executed, and a Protection Forest is logged in a large scale, the forest’s erosion control effects and ecological conservation may be greatly endangered. However, there are Ecological Forest protection regulations, and a Timber Forest logging permission system in accordance to the governmental logging plan. They control the amount and area of logging so to avoid excessive logging from a few sites. As shown in Table 19, the actual fell has been less than 30% of the annual allowable cutting amount allocated to the province by the national

government. The Hubei Province Forestry Bureau said that deliberate afforestation was executed in parallel to logging. Because of the existence of the Ecological Forest protection regulations and the governmental regulations to prevent excessive logging, the Project's effectiveness is likely to be secured.

Table 19: Annual Allowable Cut and Actual Fell in Hubei Province (unit: ten thousand m^3 /year)

Year	2000	2005	2008	2009	2010	2014
Allowable Cut	N/A	700				1,000
Fell	117	136	178	169	169	N/A

Source: Hubei Province Statistical Yearbook 2011, Amount of allowable cut was provided by Hubei Province Forestry Bureau Foreign Funds Afforestation Project Office.

The project plan recommended mixed forests with multiple species for conserving the ecological environment, but the vast majority of the forests ended up being simple ones. If an outbreak of a forest disease or pest occurs, simple forests have a higher risk of spreading the damage to the same tree species and varieties. However, the provincial bureau said that it had institutional readiness to address diseases and pests, and, as shown in Table 20, executed preventive measures between 65% and 90% of the areas that had encountered diseases and pests. Thus no problem had a negative impact on the sustainability of the project effects, and, based on the current status, possibilities of occurrence of such problem in the future are low.

Table 20: Prevention of Forest Diseases and Pests (Unit: 10 thousand ha)

	Area of Occurrence	Area of Prevention	Prevention Rate
2004	4.11	2.98	73 %
2005	4.28	3.25	76 %
2006	4.49	4.06	90 %
2007	5.43	4.36	80 %
2008	5.53	4.45	80 %
2009	4.69	4.22	90 %
2010	4.55	3.85	85 %
2011	4.23	2.79	66 %
2012	4.56	2.97	65 %
2013	4.09	2.82	69 %

Source: Hubei Province Forestry Bureau Foreign Funds Afforestation Project Office

(3) Operation and Maintenance of Facilities and Equipment

The training center whose construction was completed in 2006 in the Project has been utilized for forestry and social training, including the Project, for about 1,800 people annually. The training center was originally built in the premises of a middle school

specializing in forestry. However, the school's name was changed to the Hubei Ecological Conservation Vocational College because it was merged with a high school in 2013. Recently, the area where the training center built was designated as a redevelopment zone. At the time of the ex-post evaluation, a new training center (30,000 m^2) was under construction in another location, and it would be completed in two years. The training functions will be moved to the new center as soon as the construction is completed.

All the office equipment pieces (244 in total) were maintained by the province, city, and county project offices as well as the training center. Environment monitoring equipment pieces (44 in total) were used by the Forestry Science Academy for monitoring. Some equipment pieces such as projectors and personal computers were discarded because they became obsolete or broke down.

Out of the three vehicles purchased, two were kept by the provincial project office, and the other one by the Forestry Science Academy. The vehicles were maintained regularly and problems such as breakdown did not occur.

Accordingly, the Project's effects are likely to be sustained. By contrast, forest operation and maintenance were executed with inaccurate knowledge, and nursing was not done in the proper frequency because of such reasons as the rising labor costs. Thus a few problems were found in the operation and maintenance status.

As stated above, minor problems were observed in technical and financial aspects as well as the operation and maintenance status. Therefore the sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1. Conclusion

The Hubei Province Afforestation Project aims to improve the quality of forests in Hubei Province, and restore their multi-dimensional functions by afforestation and Mountain Closure. The Project was prompted by the increase in the importance of afforestation because of the escalation of flood damage in the Yangtze River basin area. The Project's relevance is high because its aim is consistent with the Chinese Government's development policies, development needs and Japan's aid policy. Affected by the Forest Tenure Reform, the main project implementation body was changed from small-scale to large-scale farmers. The change was a positive one for assuring forestation and for setting the sustainable system for forest management while benefitting the small-scale farmers. In contrast, a problem at the time of the appraisal is that erosion control effects by forest type were not examined. However, the problem is not taken into consideration for the relevance rating because, regardless of the forest type, a certain amount of ecological conservation effects exist, and the risk of a significant decrease in the Project's sustainability is low.

The Project's afforestation area exceeded the annual area of water and soil erosion control

of Hubei Province, and contributed to improving the forest coverage ratio and the forest stock volume. The forests are growing, and future economic impacts are expected. However, since tree plantation and management did not follow the afforestation plan, most of the forests became simple forests and a delay in tree growth was observed. Consequently, the effects on forest quality improvement and ecological conservation are limited. Thus the effectiveness and impact of the Project are fair. With regard to efficiency, although the cost of the Project was within the planned limit, the Project period was longer than planned because of the supplemental planting and additional forest building. Thus the efficiency of the Project is fair. There was no major change in the Project's executing agency, and the funds for the operation and management were secured by subsidies and the forestry bureau's budget. However, three years after the planting, forests were not maintained properly because of the rising employment costs and lack of relevant knowledge. It is necessary to upgrade technology on forestation, nursing, and thinning among engineers and farmers and disseminate accurate knowledge to them. The sustainability of the Project is fair because a few problems were observed in technical and project implementation bodies' financial aspects and the maintenance status.

In light of the above, the Project is evaluated to be partially satisfactory.

4.2. **Recommendations**

4.2.1 Recommendations to the Executing Agency

The evaluation team observed that, in many farmers' Protection Forests that were three years after being planted or older, nursing and thinning were not appropriately executed. Behind the problem lies the farmers' misconception that a high forest density saves their work on nursing and enables them to produce more timber from thinning. The farmers need to know that high-density forests have a greater risk of outbreak and spread of diseases and pests, may delay timber growth and cost more for maintenance until the trees are ready to be cut, and degrade the quality of the forests. The executing agency needs to provide additional training for farmers to disseminate accurate knowledge on planting, nursing and thinning, and to promote appropriate forest maintenance. For this purpose, it is essential to increase the number and frequency of training for and strengthen the capacity of local engineers at the county and township levels who provide technical guidance to farmers. In many project sites, Chinese fir and pine trees were shifting from the young growing period to the first thinning period (8^{th} to 10^{th} growth year) at the time of the ex-post evaluation. Thus it would be desirable to implement the measures discussed above as soon as possible.

4.2.2 Recommendations to JICA

None

4.3. **Lessons Learned**

(1) The executing agency needs not only to monitor the operation and effect indicators, but also provide guidance and supervision on if the trees are planted and maintained according to the Project's plan.

At the time of the acceptance inspection of the Project, the data on the survival and preservation rates, and the main indicators for afforestation were not correctly recorded. The inspectors gave a forest passing rate if it had more trees than specified in the afforestation regulations. This was a major cause that implementation bodies planted and maintained trees in a higher-than-appropriate forest density, then the growth of trees is inhibited, and then the forest's quality, that the Project was aiming at, is degraded. During the course of the Project, the executing agency needed not only to monitor the achievement of inspection figures such as afforestation area and survival and preservation rates, but also provide guidance and supervision on if the planting and maintenance of forests were done according to the project's plan so that the quality of the forests would have been improved.

(2) Regarding the ecological conservation standards, JICA needed to determine if the executing agency set appropriate appraisal and forest inspection criteria on implementation bodies and monitored them, and take measures for promoting the Project's effects if necessary.

In the plan at the time of the appraisal, from the perspective of the diversity of animals and plants and the stability and sustainability of forests, the Project was to plant 40 species. However, the selection of species was left to the implementation bodies who prioritized the species that they thought would be profitable. As a result, the number of species was limited to about 10 such as Chinese fir, pine, and poplar. Also, in forest design, a mixed forest using several species had been recommended, but most of the project sites ended up as simple forests, the forest density became higher than planned, making the forests vulnerable to environmental changes or forest diseases and pests. To restoration of multi-dimensional functions of forests, the executing agency needed to set criteria for selecting implementation bodies that included not only economic resources but also those pertaining to erosion control and ecological conservation such as forest design and tree species. In addition, the executing agency needed to confirm the extent of achievement of the criteria above for acceptance inspection of the Project. During the implementation of the Project, JICA should have considered carefully whether the implementation bodies who would take the lead in selecting forest design and tree species and the outside agency that would implement acceptance inspection had sufficient capacity. At the same time, JICA needed to confirm the Project's status and prospects for realizing the Project's effects through progress reports from the executing agency and mid-term supervision, and consider taking measures such as dispatching additional experts to promote the Project's effects if necessary.

(3) Based on the differences in erosion control effects by forest type, it is necessary to set the afforestation area and consider the executing agency's request for a change in the Project plan.

At the time of the appraisal, erosion control capability, which is the main effect of afforestation, was regarded as the same regardless of the forest type (Protection Forest, Economic Forest, Timber Forest, or Mountain Closure), and any afforestation method would bring about the same result. Based on this perception, JICA approved the project plan submitted by the Chinese side and a request for changing the forest area and type during the project implementation. In reality, erosion control effects differ by forest type. At the time of the appraisal, differences in ecological effects by forest type should have been examined. In addition, any change in the project plan should have been considered on the basis of the differences in the effects. Also from the viewpoint of the Project's sustainability, governmental policies and prospects on ecological conservation and logging plans should have been confirmed at the time of the appraisal.

END.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
Afforestation	**290,281 ha**	**313,378 ha**
Economic Forest	20,903 ha	21,764 ha
Protection Forest	269,379 ha	291,614 ha
Protection Forest I	47,575 ha	49,716 ha
Protection Forest II	73,518 ha	88,902 ha
Mountain Closure	152,996 ha	152,996 ha
Afforestation Material		
Seedling and Plants	324.10 million	322.37 million
Fertilizer	29,003 ton	N/A
Pesticide	589 ton	N/A
Vehicle	3 sets	As planned
Office Equipment	275 pieces	244 pieces
Environment Monitoring Tools	48 pieces	44 pieces
Training Center	2,000 m^2	2,171 m^2
Training		
Training for Managers/Engineers	N/A	618 persons
Technical Training for Farmers	90,422 persons	100,781 persons
2. Project Period	March 2004 -October 2009 (68 months)	March 2004-March 2012 (92 months)
3. Project Cost		
Foreign currency	15 million yen	7,484 million yen
Domestic currency	10,962 million yen (766.6 million yuan)	3,331 million yen (240.8 million yuan)
Total	10,997 million yen	10,815 million yen
Yen loan	7,536 million yen	7,484 million yen
Exchange rate	1 yuan=14.3 yen (as of September 2003)	1 yuan=13.834yen (the average rate used by the executing agency 2004-2013)

Attachment: Growth Situation in the Project Sites

1. Economic Forests (Species: Oil-tea Camellia, Walnut, Yellow Peach)

In all the species in Economic Forests, the preservation rate exceeded 95%. The heights, diameters, and base circumferences were normal for the tree age. The planted varieties were appropriate for the environment. No major damage by forest diseases or pests was observed. In all the sites, tree planting, fertilization, and maintenance were done properly.

Measured Data of Economic Forests

Species	Tree Age (year)	Preservation Rate (%)	Height (m)	Tree Crown (m)	Base Circumference (cm)	Density (#of tree/mu)	Project Site	Harvest /note
Oil-tea Camellia	3	95 %	1.3	0.8	2.6	130	Tongcheng	2019～
	5	95 %	1.8	1.3	4	130	Chibi	2016～
Walnut	5	100 %	3.5	3.1	9.6	33	Laohekou	2017～
Yellow Peach	7	95%	2.1	3.7	9.2	37	Laohekou	Started/ converted from Sichuan Pepper

2. Protection Forest (Species: Slash Pine, Chinese Fir, Poplar, Bamboo)

The planted varieties were selected properly. The preservation rate of all the species exceeded the target rate of 80%. The Project plan aimed to enrich biodiversity, and recommended making mixed forests by planting more than one species. However, all the sites except one were simple forests. The implementation bodies that took initiative in selecting varieties avoided mixed forests that cost more for planting and maintenance than simple forests. Since most of the sites are simple forests, the project forests have a higher chance of spreading the damage in case of diseases and pests.

2-1 Slash Pine

The planted varieties were suitable to the mountain area. Preservation rate exceeded 90%, and to some extent growing normally. Because the trees were planted higher than the appropriate density of 167 plants/mu, some negative impacts in growth status were observed. If the appropriate density was supposed to be 100%, the one in the Project sites was 177%. Because of the high density, the growth of trees is inhibited. The evaluation team visited a model forestry farm in the province and has taken data of 12 year old forests to find the normal growth level in the climate. In comparison with the data, the Project site where trees planted 10 years ago, the density was at 177% to the normal level, the trees' average circumference was at 69%, height at 56%, stock volume at 68% to the normal level of 100%. Also the Project site at seven year old, the forest density was at 133%, height and

circumference were about 60%, and volume 16% to the model farm.

Measurement Data of Protection Forest (Species: Slash Pine Mountains)

Tree Age (year)	Preserva-tion Rate (%)	Height (m)	Circumference (cm)	Density (#of tree/mu)	Stock Volume (m^3/mu)	Project Site	Note
10	90 %	6.9	10.7	296	10.41	Gucheng	
7	90 %	6.8	9.2	222	2.45	Gucheng	Fir:Pine1:1 mixed
12	100 %	12.2	15.6	167	15.23	Gucheng Jiushan Forestry Farm	Model Farm

2-2. Chinese Fir

The planted varieties were suitable to the mountain area. Preservation rate exceeded 90%. At all the Project sites, trees were planted 133% to 277% to the normal density of 167 plants/per mu. The high-density deterred growth of the trees especially in circumference, which affects to the price of timber the most. Usually, in order for gaining the maximum economic effect, the forest density should be reduced to 100 plants/mu at the first thinning period, which is seven to eight years after planting. Because of the high density, it will take 20 years or more till the trees grow to the size for timbers. The young trees nursing condition differed by the sites. At most of the sites, weeds and shrub trees were not removed from the forest beds, and necessary maintenance and nursing were not executed.

The high planting density deterred growth of trees in circumference. Timber sales price fixed by the thickness of the diameter. Thus, it is predicted that Protection Forests where trees were planted in high density would yield lower economic effectiveness.

Measurement Data of Protection Forest (Species: Chinese fir)

Tree Age (year)	Preserva-tion Rate (%)	Height (m)	Circumference (cm)	Density (#of tree/mu)	Stock Volume (m^3/mu)	Project Site	Note
7	90 %	6.5	8.5	222	2.453	Gucheng	Fir:Pine1:1 mixed
7	100 %	6.5	8.3	320	5.824	Gucheng	Average of 3 sites
7	90 %	5.0	5.7	400	2.920	Yangxin	
7	95 %	7.6	7.9	462	7.900	Chibi	
10	91 %	7.8	8.8	296	6.186	Yangxin	
35	80 %	28.3	26.9	70	31.647	Gucheng	Model Farm

2-3. Popular

One of the Project site was damaged by tornado, and the preservation rate was at 60%. Except the site, the preservation rate exceeded 80%. At some sites, plantation density was 30 trees per mu, and did not satisfy the minimum density of 41 trees per mu. Other than that, growth status and maintenance condition were fine. Among the 6 varieties planted in the field

study sites, some were slow-growing varieties. Most of the sites were simple forests, and the forests have higher risk of extermination in case of diseases or pests

Measurement Data of Protection Forest (Species: Popular Mountain)

Tree Age (year)	Preserva-tion Rate (%)	Height (m)	Circumference (cm)	Density (#of tree/mu)	Stock Volume (㎥/mu)	Project Site	Variety
10	90 %	18.3	15.3	74	10.00	Tongcheng	ZhongJia 7
10	90 %	14.5	13.6	74	6.92	Gucheng	Zhonglin 46

Measurement Data of Protection Forest (Species: Popular Plain)

Tree Age (year)	Preserva-tion Rate (%)	Height (m)	Circumference (cm)	Density (#of tree/mu)	Stock Volume (㎥/mu)	Project Site	Variety
6	80 %	18.1	21.0	56	14.78	Jianli	ZhongJian3
8	90 %	20.0	21.5	40	11.96	Jianli	ZhongJian3
9	85 %	22.1	23.4	40	15.25	Jianli	ZhongJian3
9	90 %	13.9	18.2	28	4.51	Laohekou	Nanlin 895
8	60 %	15.7	20.9	28	6.62	Laohekou	Nanlin 895 Damaged by tornado
8	85 %	15.7	20.0	42	9.05	Laohekou	Oumei 107
8	80 %	13.8	15.4	49	5.84	Laohekou	Oumei 107
9	85 %	13.3	15.0	37	3.98	Laohekou	Liaohe

2-4. Bamboo

Bamboo seedlings planted at 33 plants/mu in 2006, and they multiplied to 160 plants/mu in eight years after the planting. Another site of Moso-bamboo, seedlings were transplanted at 50 plants/mu in 2005, increased to 150 plants/mu. The bamboo forests were not thinned to the appropriate level, and did not grow enough to be cut and used as industrial materials.

3. Mountain Closure

Before the implementation of Mountain Closure, farmers cut the pine and oak trees for fuel, thus the growth of trees in the forests were prevented. After the implementation, new forest stations set by state-owned forest farms, have been managing the closure. After five year of closure, the forest density improved from 0.2 to 0.6－0.7, and ecological effects were confirmed. The stations have been closing the area by building fence and signs. Economic effects can be promoted by pruning trees in good growth.

END.