People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan

"Jiangxi Province Afforestation Project"

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0. Summary

The Jiangxi Province Afforestation Project (hereinafter referred as to the "Project") aims to improve the quality of forests in Jiangxi Province, and to 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 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. The afforestation plan should have been drawn in accordance with the flood and erosion damages based on examination of effects. 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 planted trees in the area equivalent to 18% of the water and soil erosion control area of Jiangxi Province, and contributed to improving the forest coverage ratio and forest stock volume[2]. The forests are still growing but expected to bring economic impacts in the future. However, because tree planting and forest management did not follow the afforestation design, the improvement in the quality of forests and ecological conservation effects are limited. Thus the effectiveness and the impacts 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 forests 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

[1] The Forest Tenure Reform was meant to allocate ownership of forest lands to individual farm households. In Jiangxi Province the reform was executed between 2004 and 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.

operation and management of the Project were secured by subsidies and 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 implementation bodies' financial aspects and the maintenance status.

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

1. Project Description

Project Location

Photo 1: Chinese Fir forest
(Jiangxi Province Yongxing 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 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 "National Plan for Ecological Construction". The plan set prioritized projects for natural environment improvement, their target areas, and quantitative goals, and launched large-scale afforestation projects. Jiangxi Province was a part of the target area of the Yangtze River Basin Shelter Forest program and the program of Converting Steep-Farmland Back to Forest. At the time of the appraisal, forest coverage ratio in Jiangxi Province was 53%, 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 21% of the provincial territories. The drained soil that raised the river and lake bed also exacerbated the damages by

floods and other natural disasters. Under such circumstances, the Jiangxi 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 to 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 Jiangxi Province.

Loan Approved Amount/ Disbursed Amount	7,507million yen / 7,506 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March 2004 / March 2004
Terms and Conditions	Interest Rate 0.75% Repayment Period 30 years (Grace Period) (10 years) Conditions for Procurement: General Untied
Borrower / Executing Agency	Government of People's Republic of China/ Jiangxi Province People's Government
Final Disbursement Date	August 2012
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 Jiangxi Province, July2002
Related Projects	● Gansu Afforestation and Vegetation Cover Project (L/A 2003) ● Hubei Province Afforestation Project (L/A 2004) ● The Japan-China Cooperation Science and Technology Center for Forest Tree Improvement Project (Technical Cooperation 1996-2006) ● Forestry Development in Poor Areas Project (World Bank 1999-2005) ● EU Bank Energy Forest Building Project (EU Bank 2003-2009) ● ADB Loaned Afforestation Project (ADB 2005-2012)

[3] Mountain closure is a measure to promote natural growth of tree and vegetation in the area by prohibiting the entry of people and live stocks.

Figure 1: Project Sites in Jiangxi Province

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 11, 2014 – November 22, 2014

2nd Field Study: April 16, 2015 – April 19, 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 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

[4] The Project was implemented in 36 counties, which is a vast area. It was impossible to conduct a field

growing and not ready for an observation of their fully developed status. Secondly, the Project covered a vast area consisting of 36 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 (1998–2050), the Government of China set four target areas for natural environment protection and restoration. Jiangxi Province was included in the Yangtze River Basin area where soil loss and afforestation were the prioritized agenda.

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

Under the 12th Five-Year Plan (2011-2015), Jiangxi 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 12th Five-Year Plan (2011–2015) of Jiangxi Province also aimed at development through conserving the ecological environment and harmonizing the society with the economy. The provincial plan was to promote afforestation and reforestation by converting steep-farmlands to forestlands, protect natural forests, promote Mountain Closure, and use forests as a means of erosion reduction for flood control.

To implement the policies, the Jiangxi Provincial Government encouraged the use of foreign loans. Since 1990's, the government has executed afforestation projects funded by the World Bank, and the Japanese Government. A large-scale project is needed to attain the policies' goals in 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 close period, and thus the implementation of the Project is

study in all the counties during the evaluation study period. To address this problem, the evaluation team asked the Jiangxi 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.

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

[6] ③: High, ② Fair, ① Low

relevant.

Table 1: Foreign Funded Afforestation Projects

Project	Donor	Duration (year)	Afforestation Area（ha）	Cost (million yuan)
Forestry Development in Poor Areas Project	World Bank	1999-2005	55,401	260
EU Bank Energy Forest Building Project	EU Bank	2003-2009	20,287	560
ADB loaned Afforestation Project	ADB	2005-2012	50,862	450
The Project	Japan	2004-2012	236,548	730

Source: Jiangxi Province Forestry Bureau Foreign Funds Afforestation Project Office.

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 Jiangxi Province were not maintained properly, and the quality deteriorated. The average forest stock volume in Jiangxi Province was 32.3m^2 /ha at appraisal, 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 was estimated that 200 million tons of soil inflows into Yangtze River annually. The soil inflow raised the bed, and made the river basin vulnerable to natural disasters, such as floods. It was also a cause of flood damage that cost more than 10 billion yen in a year. The Jiangxi provincial government prioritized the improvement of forest quality, and aimed to implement afforestation in a total area of 1.27 million ha through the Jiangxi 10th Five-Year Plan (2001-2005).

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

At the time of the ex-post evaluation, the average stock volume in Jiangxi province was 40.6 m^3 /ha[7], which was still far below the national average of 70.2 m^3 /ha[8]. The forest coverage ratio reached to 63.1%[9], which is above the national average of 20.4%, and the forest area kept increasing. However, the forests' multi-dimensional functions such as water and soil retention capability were still at a low level because the forests consisted mostly of newly-planted young trees, and the quality of most of the forests was not very good. According to the National Ministry of Water Resources, the water and soil erosion area in Jiangxi Province in 2010 reached nearly 1,813 thousand ha, which was equivalent to 10% of the

[7] Jiangxi Province Statistical Yearbook (2013)
[8] 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.
[9] Jiangxi Province Statistical Yearbook (2013)

national damaged area of 17,525 thousand ha. Therefore the situation remained serious.

The 12th Five-Year Plan (2011-2015) of Jiangxi province laid out the goals to increase the forest area to 10.13 million ha, the forest coverage ratio to 64%, and the forest stock volume to 500 million m^3 by adding 55 million m^3 in one year. 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

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

3.1.4. Appropriateness of the Project Plan and its Approach

The project documents provide 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 Feasibility Study 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 an incentive 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 the forests were necessary resource to make the project sustainable[11]. It is undeniable that the two sides'

[10] The Project's effect, "restoration of forests' multi-dimensional functions" was determined as ecological 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] There was no description what "social and economic effects by enriching forest resources" meant in the Project documents provided by JICA. The definition was confirmed by interview to a JICA person

interpretations differed on the main effect of "restoration of forest's multi-dimensional functions." The difference became apparent after the project commencement through the major modification in the Project plan at the time of appraisal and Project approaches. The following are the modifications and their relevance.

(1) Changing the Project's Participants

The Project's approach was to have individual farmers, farmers' groups, collective forest farms, and state-owned forest farms[12] plant trees for improving the ecological environment of their farms. For this purpose, the main implementation bodies would have been small-scale farmers, and they were to have built Protection Forests, Economic Forests and set Mountain Closure areas in their own lands[13] for environmental effects and poverty reduction. The farmers were to have provided necessary manpower for nursing and forest maintenance and have earned income from the timber from thinning and forest products. In reality, farmers with larger forests became the main implementation bodies of the project, and the number of the participants was about 30% to the original plan.

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 farming households. Small-scale farmers who allocated small areas have chosen to participate in the project by organizing association with other farmers, or chosen to rent their lands to large-scale farmers or enterprises to earn rental fees, or chosen to provide man-power and earning labor wage.

The farmer or farm wishing to participate in the Project, applied to their county forestry bureau and signed the loan agreement. Large-scale farmers belonging in associations, and enterprises became the main 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 material for planting and maintenance costs before the 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

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at screening.

[12] Mountain Closure is a measure to promote natural growth of trees and vegetation by prohibiting the entry of people and livestock in the area. It incurs maintenance costs but generates no financial profit. Thus Mountain Closure areas were allocated to only state-owned forest farms because they were for the public interest.

[13] The plan at the time of the appraisal expected that 57,164 farmers would take part in the project. The expected average forest size per farmer was about 1 ha.

from leveling before planting, securing costs for management and repayment, and employing necessary manpower for forest management.

Thus, the change was better alternative 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 and 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 which was consisted of the effects of soil erosion reduction and ecological conservation through afforestation. As explained in ①and ②below, JICA should have provided supervision and guidance to the Project through the executing agency on the following: whether the Project examined the appropriateness of appraisal and change regarding afforestation methods, selection of tree species, and forest design based on difference in effects on the project objectives and contribute to the effects.

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[14], Economic Forest[15], Timber Forest[16], or Mountain Closure[17]). Based on the recognition above, the project plan set the afforestation method and areas according to the Chinese needs. During the implementation of the Project, the executing agency requested to increase Timber Forests and artificial afforestation. At that time, the difference on erosion control effect by afforestation method was

[14] According to "Forestry Law of China" (below definitions referred the same law), Protection Forest is a forest including water conservation, water and soil retention, engineering sand fixation, farm land protection, revetment forests, and road-side trees.
[15] Economic Forest is purposed to produce fruits, oil, drink, seasoning, industrial material and medicine.
[16] Timber Forest is mainly for timber production. Bamboo forest is included in the definition.
[17] 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.

not considered. In an afforestation project that aims to control soil erosion, usually the location of Protection Forest shall be decided first depending on the needs to control soil erosion, and then the area of Economic and Timber Forest shall be decided according to the economic needs. The Project did not follow the procedure above and prioritized needs of the Chinese side.

② Effect to Ecological Conservation

At the appraisal ecological conservation was defined as enrichment of forest resources and biodiversity. The forest design of the project plan aimed to build mixed-forest 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 utilize limited species of trees, therefore the intended biodiversity was not actualized. Also, when forest diseases and pests occurred, simple forests have higher chances to spread the damage to the same species and varieties, thus durability of the forests were weakened. In order to build and maintain a forest with quality, the forest sector expert said that promotion of stable growth of trees was important, therefore mixture of broad-leaf and needle-leafed trees was desirable. The project's contribution to improvement of forest quality, as required in development needs, was limited because most of the Protection Forests ended up to being simple forests.

This Project has been highly relevant with the development policies of the Chinese and Jiangxi Governments, the development needs as well as 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 the problem did not compromise the Project's relevance seriously. Therefore, it is fair to say that the relevance of the Project is high.

3.2. Efficiency (Rating: ②)

3.2.1. Project Outputs

The Project's envisioned output at appraisal was consisted of afforestation, afforestation material, vehicle, facilities and equipment, nursery facility, irrigation system, training center construction and training/ technical guidance. The plans and the result of each item in this project are as shown in Table 2.

Table 2: Output

Item	Plan (Target year 2009)	Result (Project completion 2012)
Afforestation		
Afforestation	219,203 ha	235,890 ha
Timber Forest	65,637 ha	87,389 ha
Economic Forest	5,350 ha	2,077 ha
Protection Forest	148,180 ha	146,424 ha
Mountain Closure	52,167ha	42,411 ha
Afforestation Material		
Afforestation Material		
Seedling	167.97 million	370.84 million
Seed	151.8 ton	Import 3.43 ton Domestic N/A
Fertilizer	20,498 ton	Cancelled
Facilities and Equipment		
Vehicle		
Forest Monitoring Vehicle	44 sets	40 sets
Motorcycle	90 sets	8 sets
Farm Vehicle	None	4 sets
Office Equipment	167 pieces	87 pieces
Environment Monitoring Tools	36 pieces	22 pieces
Nursery Facility		
Small Nursery House (350 m^2)	5 places	3 places
Middle-size Nursery House (600 m^2)	5 places	Canceled
Large Nursery House (800 m^2)	2 places	2 places
Irrigation	30 hm^2	20 hm^2
Sprinkler	3 sets	1 set
Battery for nursery	3 sets	As planned
Construction	6,446 m^2	3,000 m^2
Dam	None	2,500 m
Leveling	None	70 hm^2
Training Center	4,000 m^2	built in the premises of the provincial forest bureau
Training		
Overseas Training	3 times 60 persons	3 times 45 persons
Province (Manager/Engineers)	N/A	15 times 1,560 persons
City (Manager/Engineers)		21 times 150 persons
County (Manager/Engineers/ Forest Farm Engineers/ participants)		186 times 25,000 persons
Technical Guidance(participants)	N/A	29,000 persons

Source: Jiangxi Province Forestry Bureau Foreign Funds Afforestation Project Office

(1) Scope of the Project

At the appraisal, the Project was to be implemented at 7 cities 36 counties because national afforestation projects launched before the project, and used provisional forest lands was used for the national afforestation projects. With the reason, Yihuang county and Changjiang district withdrawn, and as the alternation, Guangfeng and Shangli counties joined the project. Besides the above change, one county level unit was changed to two forest farm units, the 7 cities 37 counties executed the project. As the project whole, the scope was as planned.

(2) Forested Area

The actual afforestation area was 235,890 ha in total, which was 108% to the planned area of 219,203 ha. The breakdown consisted of 87,389ha of Timber Forest, Economic Forest of 2,077 ha, and Protection Forest of 146,424 ha. Of the Protection Forest, the afforestation area of Mountain Closure was 42,411 ha.

In reality, the area of Timber Forest largely increased[18], amounted 37% of the afforestation area in total, while at the planning the area of Timber Forest amounted 30%. According to the hearing to the provincial government and the local forestry bureaus, Protection Forests are practically recognized as Timber Forests, thus without the area of Mountain Closure more than 80% of the project total afforestation area is practically considered as Timber Forests. According to the Provincial Forestry Bureau, 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.

With regard to the artificial afforestation and reforestation areas, the project plan at the time of the appraisal set the reforestation area as 186,422 ha, i.e., 85% of the total area. However, the artificial afforestation area was eventually increased to 117,143 ha, nearly the same as the reforestation area of 118,747 ha. The provincial forest bureau applied for the change on the basis of the mistaken notion that artificial afforestation had better multi-dimensional functions,[19] and JICA approved the application as well. The artificial afforestation area increased to 117,143 ha, which was 357% to the planned area of 117,143 ha, and the reforestation area decreased to 118,747 ha, which was 64% to the planned area of 186,422 ha respectively.

As mentioned in the section on relevance, forest type and selection of species should have been examined and decided on the basis of differences in erosion reduction and ecological conservation effects that the Project was aiming at. The effects and influences on future forests by the change in forest type will be discussed in the sections on effectiveness and sustainability.

[18] The former JBIC explained that Timber Forests would satisfy the requirements on economic and ecological effects better and approved the change. The ecological effects were recognized as follows: Timber Forests have a larger area of leaves and branches as well as higher rainwater retention effects, thus yield higher erosion control effects. However, according to a local forestry expert, the notion above is inaccurate because there is no correlation among forest type and species, leave and branch area, and rainwater retention and erosion control effects.

[19] In artificial afforestation, soil erosion prevention effects decrease in nearly the five-year period between planting and the time that trees are fully grown, but the effects afterward are the same as those of reforestation. Reforestation helps enrich forest resources and promote biodiversity because it increases tree species in the existing vegetation.

Table 3：Area of Artificial Afforestation and Reforestation (unit: ha)

	Target at Appraisal (2009)		Result at Completion (2012)		Target/ Result Ratio
	Area (ha)	Ratio	Area (ha)	Ratio	
Artificial Afforestation	32,781	15 %	117,143	49.7 %	357 %
Reforestation	186,422	85 %	118,747	50.3 %	64 %
Total Area	219,203	—	235,890	—	

Source: Jiangxi Province Forestry Bureau Foreign Funds Afforestation Project Office

Table 4: Project Area and the Ratio of Afforestation/Reforestation (unit: ha)

Type of Afforestation / Improvement	Planed Area (2004)	Result (2012)	Plan/Result Ratio
Timber Forest	65,673	87,389	133 %
Artificial Afforestation	16,101	59,358	369 %
Improvement of Young Growth Forest[20]	49,572	28,032	57 %
Economic Forest	5,350	2,077	39 %
Protection Forest	148,180	146,424	99 %
Artificial Afforestation	6,850	55,454	836 %
Improvement of Poor Stand[21]	35,010	4,148	11 %
Improvement of Low Yield Mao Bamboo forest[22]	38,743	42,826	110 %
Improvement of Secondary Broad-Leaved Forests[23]	10,930	1,331	12 %
Four-Side Afforestation[24]	4,480	255	6 %
Mountain Closure	52,167	42,411	81 %

Source: Jiangxi Province Forestry Bureau Foreign Funds Afforestation Project Office

(3) Afforestation Materials

The planned number of the seedlings to plant at the time of the appraisal was 167.97 million. The actual number of planted seedlings was 370.84 million, i.e., 221% of the plan. It was due to the increase in the afforestation area in the Project as a whole and the change of the reforestation area to artificial afforestation. Another cause was that the seedlings were planted in a higher density than planned. The Project imported seeds from overseas in bulk. However, the total amount of the procured seeds is unknown because seeds made in China were purchased by each county and a few local governments provided subsidies for the purchase. Bulk purchase of fertilizer was cancelled, and each county procured it according to its needs. The reasons include that Economic Forests requiring a large quantity of

[20] A method to improve young growth forests that are three years after planting or older by providing maintenance tasks such as fertilizing, pruning, and thinning.
[21] A maintenance method to improve the forest's protection functions by controlling the density of existing natural forests, weeding, or supplemental planting.
[22] A method to improve a bamboo forest's quality by controlling the density of the existing bamboo forest, soil condition and fertilization so that the ecological environment is better and revenues from the forest increase.
[23] By pruning, thinning, and controlling the density of existing broad-leaved trees, this method provides sufficient water and fertilizer for the trees' growth. The purposes of the method are to make the forests retain and conserve water and yield more products.
[24] A kind of Protection Forest in which trees are planted to surround a farmland or house, or on both sides of a road.

chemical fertilizer decreased, and that farmers used self-procured organic fertilizer for environmental considerations.

(4) Facilities and Equipment

After the project started, the executing agency reexamined the necessary amount of facilities and equipment, and reduced the purchase amount of motorcycles, office equipment and environmental monitoring equipment, number of nurseries to build, and irrigation facilities. The training center was built in the premises of the provincial forest bureau. The center reduced time for moving during training sessions, increased convenience, and helped save the maintenance costs.

(5) Training

① Overseas Training

The original plan was to dispatch a total of 60 project office personnel of the province, city, and county forestry bureaus to such locations as Gifu and Okayama prefectures in Japan. However, the number of project office personnel to dispatch was reduced to 45 because of the instructions of the Jiangxi provincial government.

② Training in China

Training sessions in China were provided to a total of 26,710 staff members and engineers of the province, city, county forestry bureaus and forestry stations. It is unclear how many implementation bodies were trained because the trainees included engineers of county and state-owned forestry farms.

③ Technical Guidance

The provincial government provided technical guidance to more implementation bodies than had been planned because of the addition in the afforestation area. The beneficiary survey revealed that 95 out of the 100 respondents received technical guidance, and the average number of technical guidance sessions was 9.2 per implementation body. Many implementation bodies received technical guidance more than once, but a few implementation bodies did not receive it. Thus the coverage of technical guidance was imperfect.

With regard to the output, the afforestation area increased to 108% the one of the planned. However, in reality, the implementation bodies took control of the selection of type and species, and prioritized economic effects. As the consequence, more than 80 of the total forests became practically Timber Forests.

The executing agency should have controlled in selection of forest type and species. The executing agency reexamined the necessary amount of facilities and equipment and reduced the purchase amount, which contributed to saving the cost. Appropriateness of the number of trainees was not able to be evaluated because the planned number was not available.

3.2.2. Project Inputs

3.2.2.1 Project Cost

The planned project cost was 10,065 million yen in total (of which the ODA loan portion accounted for 7,507 million yen). The actual project cost was 10,062 million yen (of which the ODA loan portion was 7,506 million yen), which was within the planned amount (99% of the planned). In the planned project cost, the afforestation cost was to be 7,843 million yen. However, the actual afforestation cost was 9,662 million yen, i.e., 123% of the planned one. This was because the afforestation area increased to 108% of the plan, the actual number of seedling planted doubled to the planned one, and 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.

3.2.2.2 Project Period

Although the planned project period was 70 months from March 2004 to December 2009[25], the actual project period was 95 months from March 2004 to June 2012, i.e., 136% of the planned one. At the originally planned project completion time, the project period was extended because of the following reasons: supplemental planting in the rejected area and the area damaged in the major snowfall in 2008[26]; and additional artificial afforestation[27] using the surplus of reserve funds and management costs until 2012. Because of the additional artificial afforestation and supplemental planting, the total extended period was 25 months, which was equivalent to 36% of the planned project period. However, afforestation area during the extended period was less than 10% of the total. Therefore, the extension exceeded the addition in outputs.

[25] The definition of the project completion was agreed as when the total area of the project pass the third growing year inspection on survival rate.
[26] The snow damaged 78,700 ha, which was equivalent to 10% of the afforestation area. Especially bamboo forests, 60% of the total, 29,300 ha damaged. Number of seedling for supplemental planting reached to 3,936,000 in total.
[27] The artificial afforestation area added was 1,093 ha in total, included Economic and Protection Forests.

3.2.3. Results of Calculations of Economic Internal Rates of Return

Since the main objective was to restore forests' multi-dimensional functions such as conservation of ecological environment and erosion control, a quantitative analysis of the internal rate of return was not developed at the time of appraisal. During the project execution, EIRR was not calculated, thus the ex-post withheld EIRR analysis.

As above mentioned, the project cost was within the plan, though the project period exceeded the plan. Therefore, efficiency of the Project is fair.

3.3. Effectiveness[28] (Rating: ②)

3.3.1. Quantitative Effects (Operation and Effect Indicators)

The main component of the project was afforestation. Therefore the effectiveness was to be evaluated by the quantitative indicators set at the appraisal, forests condition at the field study, forest coverage ratio and stock volume. Regarding the impacts, in addition to the reduction of erosion and ecological conservation, economic and social impacts that were to be the motivation for the participants to plant trees and provide maintenance work to the forests, and also to secure the sustainability, as the part of "restoration of the multi-dimensional functions of the forests." Since training was not the main component of the project, its effects were to be evaluated, not in the effectiveness and the impacts, but at the technical aspect of operation and maintenance in the sustainability section.

(1) Survival Rate, Preservation Rate[29], Forest Density[30]

The calculation methods differed between the targets for the survival rate[31], preservation rate[32], and forest density set at the time of the appraisal and the results 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[33] for this ex-post evaluation revealed that, in forests five to ten years after planting, all the figures exceeded the standards, i.e.,

[28] Sub-rating for Effectiveness is to be put with consideration of Impact.
[29] 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.
[30] 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.
[31] 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.
[32] 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.
[33] Number of the planted trees was judged comprehensively by the data provided at interviews to the implementation bodies, and by observing the spaces in forests where died trees used to be.

minimum preservation ratio of 85%, average preservation rate 96.4%, and forest density of 0.4 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, the evaluation team observed that more number of trees planted in the Project's Protection and Timber Forests than the plan, and necessary thinning work were not executed. The adequate plantation density was 167 plants/mu[34] for Protection Forests and 146 plants/mu for Timber Forests. Then at tree age of 8-year, the forests' density is to be controlled to 106 plants/mu by thinning. In reality the density kept higher than the standards. The density of the Chinese fir forest was at 193 plants/mu in average, and the one of pine forests was 161 plants/mus. To confirm the facts more in depth, the team interviewed engineers and managers of the provincial government 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

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 are 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.

[34] Mu is a common Chinese unit of measure for land. 15 mu is equivalent to 1 ha.

Photo 2: Bamboo Forest recovered from snow damage（Jiangxi Province, Fenyi County）

Photo 3: Protection Forest of Slash Pine. (Jiangxi Province, Fengxin County)

3.3.2. Growth Situation in the Project Sites

The evaluation team conducted field study at 20 project sites[35] of 6 counties in total. The sites included Protection Forests, and Mountain Closures. The team examined forest design, maintenance status, and preservation rate for the planted trees. Also the height, circumference and so on measured so to inspect the growth of the trees. Summary of the result is as following, and the detail and the measurement data are mentioned in the attachment.

(1) Protection, Timber Forests

This section does not differentiate Protection Forests from Timber Forests because the former were grown practically as the latter. Needle-leaved trees (Chinese fir, pine) occupied 70% of all the forests, broad-leaved trees (liquidambar, oak, paulownia, Chinese tulip trees) 20%, and other species 10%. At the time of the ex-post evaluation, the average preservation rate was 96.4%, which exceeded the target rate for the third growth year.

The project plan aimed to enrich biodiversity, and recommended creating mixed forests by planting more than one species. However, 95% of the visited sites were simple forests[36]. The major reason was that the selection of tree species was left to implementation bodies who avoided mixed forests that cost more for plantation and maintenance than simple ones. In addition, nursing and thinning were not done properly, weeds and shrub trees were not removed from the forest beds, and the forest density was not kept at the adequate level. However, the climate of Jiangxi Province is favorable for afforestation, and the high forest

[35] The field study concentrated on visiting forest sites with designs of larger percentages because the area of the Economic Forests was less than 1% of the total.
[36] The species and the varieties planted in the forests were confirmed by interviews with the implementation bodies, their records, and visual observation.

density did not affect the growth of the trees with regard to their heights and diameters. To build and maintain quality forests, mixed forests of needle-leaved and wide-leaved trees that promote stable growth of trees are desirable. However, the fact that most of the project's forests ended up as simple ones may have a negative impact on the project's effect on forest quality improvement in the future.

Four-side afforestation [37], a type of Protection Forest, needed better management and concrete countermeasures because damage from human activities with malicious intent was observed (refer to the Photo 4). Bamboo forests were maintained and fertilized appropriately. The forests yielded not only bamboos for industrial material but also edible bamboo shoots in a stable manner.

(2) Mountain Closure

Forest density[38] improved from 0.2 before the project to 0.4 after 9 years of closure. Water and soil erosion effects confirmed.

Photo 4: A tree in a Protection Forest, which damaged from human activities. (Jiangxi Province, Dexing city)

Photo 5: Mountain Closure area for erosion control purpose. (Jiangxi Province, Guangcheng city)

3.3.3. Forest Coverage Ratio and Stock Volume

As shown in Table 5, 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 the province exceeded 154% and project counties did 120% as shown in Table 6). Thus it is fair to say that the intended project effect was attained.

[37] A type of Protection Forest with trees surrounding a farmland or house, or on roadsides. In the site visited, which was rented by a farm household, poplar trees were planted on both sides of a major road.
[38] 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.

Table 5: Forest Coverage Ratio

	Baseline	Target	Result
	Appraisal (1998)	One year after Completion (2010)	One year after Completion (2013)
Province	53 %	61 %	63.1 %
Project Counties	58 %	62 %	66.9 %
Project Sites	—	Increase 0.9 %	Increase 3.7 %

Sources: Target refer to JICA document at appraisal, Provincial result refer to Jiangxi Province Statistical Year Book, the project counties and sites result provided by Jiangxi Province Forestry Bureau Foreign Funds Afforestation Project Office.
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 6: Stock Volume[39] (unit: million m^3)

	Baseline	Target	Result
	Appraisal (1999)	One year after Completion (2010)	One year after Completion (2013)
Province	289.927	N/A	445.3055
Project Counties	173.14	N/A	208.44

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

3.4. **Impacts**

3.4.1. Contribution to Erosion Reduction

In Jiangxi Province, erosion control projects were implemented in the total area of 1,340 thousand ha between 2004 and 2012 by such means as biological methods of afforestation and Mountain Closure, and riverbank reinforcement. The project's afforestation area in the same period was 236.5 thousand ha, i.e., 18% of the total area of the provincial projects above. Thus it is fair to say that the project contributed significantly to erosion control (Table 7).

The ratio of the water and soil erosion area to the entire area of Jiangxi Province was 21% before the project implementation, but decreased to 16% after the project. The ratio of the water and soil erosion area to the district area also decreased from 17.4% to 16.3% (Table 8).

Regarding the erosion area by severity level, the area of strong erosion decreased from 22.2% to 9.6%, super strong one from 7.5% to 2%, and Hyper-strong from 4.8% to 0.3%, respectively (Table 9).

[39] 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.

Table 7: 2004-2012 Water and Soil Erosion Control Measured Area and the Project's Afforestation Area (unit: thousand ha)

Jiangxi Province	W&S Erosion Control Measured Area	The Project's Afforestation Area
2004-2012	1,340	236.5

Source: Jiangxi Province Statistical Yearbook

Table 8: Comparison of Water and Soil Erosion Area

	year	W&S Erosion Area (million ha / year)	% of W&S Erosion Area to the territory
Province	Before (1996)	3.52	21 %
	After (2013)	2.65	16 %
Project Area	Before (1996)	1.075	17.4 %
	After (2013)	0.966	16.3 %

Sources: Target refer to JICA document at appraisal, Provincial result refer to Bulletin of The First National census for soil and water conservation, the project area result provided by Jiangxi Province Forestry Bureau Foreign Funds Afforestation Project Office.

Table 9: Water & Soil Erosion Area in the Project's Area by Severity Level (unit: 10,000 ton/ha/year)

	Mild 500-2,500	Moderate 2,500-5,000	Strong 5,000-8,000	Super Strong 8,000-15,000	Hyper Strong >15,000	Total
Before (1996)	41.4	27.7	24.7	8.4	5.3	107.5
Ratio to the Total	37.2%	28.3 %	22.2 %	7.5 %	4.8 %	100.0 %
After (2013)	57.4	27.5	9.4	2	0.3	96.6
Ratio to the total	58.9%	28.3 %	9.6 %	2.0%	0.3%	100.0 %

Sources: Jiangxi 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.

About enrichment of biodiversity, in order for achieving diversity of species by afforestation, the appraisal plan recommended to build mixed forests with about 40 species. The diversity ended up to be limited, because the selection of species was left to the participants preference, the planted species were mostly pine and fir trees, about 10 species in the overall project. At the field study, 95% of the forests were simple forests. If forest diseases or pests occurred in simple forests, chances of spreading the damage to the same species and varieties are higher.

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 as shown in Table 9, to the question comparing the income from the forests before and after the Project, 94% 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 participants increased their forest area and production scale, and in some parts of bamboo reforestation area production of bamboo shoots increased successfully. 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 the Protection and Timber forests would take more years until the trees were to be 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.

In the survey on forestry farm managers[40], all the respondents said that both the income of the employees in all the farms and employment opportunities increased by taking part in the project. The average income became more than double the level before the project (Table 10). In addition, 25 out of the 28 surveyed farms said that the project helped improve the farms' management.

The project brought about such economic and social impacts by afforestation as an increase in income and employment opportunities. In five to ten years, Economic Forests will reach the tree age that allow farmers to earn stable income; Protection Forests will reach such tree age in 20 to 30 years. Accordingly, it is likely that the project would bring about economic impacts as expected.

[40] The questionnaire survey was conducted to the forest farm managers in the 6 counties for the field-study. Sampling was done by the county government, and sample farms were chosen from the list of forest farms.

Table 9: Result of the Beneficiary Survey (100 samples)

Has your income increased since participatory of the Project?	
Income increased significantly.	32 %
Income increased in some extent.	62 %
No change.	6 %
Income did not increase much.	0 %
Income did not increase at all.	0 %
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 10: Changing of Forest Farm Employee's Income (average of 28 Forest Farms)

	Baseline (2004)	Target at Project Completion (2010)	Income at Ex-post Evaluation (2013)
Average Income	10,935 yuan/year	17,161 yuan/year	22,523 yuan/year
Ratio to 2004	-	157 %	206 %

Source: Survey on Forest Farm Manager

(2) Social Impacts from Afforestation

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. It is thus assumed that expected social impacts from the Project materialized.

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. The bureau encouraged the use of organic fertilizer for Economic Forests.

(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 equivalent to18% of the one covered by the provincial water and soil control measures, and contributed to improving the forest coverage ratio and the stock volume. However, 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 Jiangxi Province Forestry Bureau Foreign Funds Afforestation Project Office[41] 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. Table 11 shows the numbers of human resources of the 37 project-participating counties' forestry bureaus and project offices. Among the counties, the project offices of six counties were disbanded because of the project's completion. Supervision and monitoring the forests were carried out by forest bureaus at the county level, and forest stations at the township level.

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.

[41] Project Office is in charge of general administrative work of the Project.

Table 11: Number of Human Resources in Project Offices and Forestry Bureaus' Engineer of the participated 37counties (unit: persons)

	County Project Office					County Forestry Bureau Engineer				
	Total	Manager	Engineer	Finance	Other	Total	Senior	Middle	Entree	Assistant
Plan (2003)	357	123	150	71	13	279	19	114	106	31
Actual (2014)	176	31	91	22	30	109	24	62	18	0

Source: Jiangxi 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.[42] 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 nursing, 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.

In the state-owned forest, employees rotate shifts to conducted patrolling for preventing forest fires and controlling diseases and pests according to the manuals prepared by the farms.

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.

[42] 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 (land of more than 50 mu, i.e., 3.3 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 the engineers, whose mandate was to provide technical training and guidance to the implementation bodies, was conducted for those of the provincial, county, township, and state-owned forest farms. According to the survey for engineers who took part in the training (Table 12), 90% of the respondents took the course on afforestation techniques, and more than 60% took the ones on nursery and forest management, but about half took the ones on disease and pest control and nursing and thinning techniques. The probable reason for this imbalance in the courses taken is that the engineers were not interested in nursing and thinning because the forests had not reached the thinning stage at the time of the training.

Table 12: Result of Survey for Engineers (38 samples)

What subject(s) did you learn at the training(s)?		How the training affected to your skills?	
Afforestation Technique	92 %	Afforestation Technique improved.	90 %
Nursery	61 %	Tree planting skills improved.	55 %
Forest Management	61 %	Managed forest appropriately	63 %
Forest Diseases and Pests Control	55 %	Prevented and cured forest diseases and pests	50 %
Nursing and Thinning Technique	55 %	Nursing and Thinning appropriately implemented.	58 %
Fertilizer	42 %	Use fertilizer appropriately.	42 %
		Motived to plant more trees	58 %
		Managed funds appropriately.	29 %

As shown in Table 13, the beneficiary survey revealed that 90% of the respondents took the course on afforestation techniques, 70% took seedling and plants handling. But only 16% 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, no respondents credited thinning course with any practical benefit.

The provincial government has noticed the problem that farmers planted trees in high density because of the misconception, and they have not executed necessary thinning and nursing work. To address the problem, the government has been providing additional trainings and technical guidance to the farmers. Lack of scientific knowledge on maintenance and management work has been causing the problems, thus dissemination of accurate knowledge and technology to the farmers and ensuring forests management are necessary.

Table 13: 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	90 %	Afforestation technique improved	87 %
Seedling and plants handling	72 %	Seedling and plants handled appropriately	62 %
Forestry diseases and pests prevention	57 %	Prevented and cured forest diseases and pests	58 %
Fertilizer usage	30 %	Fertilizer used appropriately	39 %
Forest management	43 %	Managed forest appropriately	46 %
Funds management	22 %	Managed funds appropriately	31 %
Products and thinning cut sales	16 %	Sold products and thinning cut appropriately	0 %
		Motived to improve afforestation technique	40 %

According to interviews in the field study, training and technical guidance were provided before planting and until the time of inspection at 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. In its replies to the questionnaire survey, the provincial forestry bureau said that 20 among the 25 counties that had many farmers participating in the project faced “partial shortage of training,” and two counties had “considerable shortage of training.” The bureau saw such situation as a problem. To address the problem, the bureau provided additional training to county-level engineers even after the project completion in order to have them disseminate knowledge and implement technical guidance to farmers. Thus it would be desirable to disseminate accurate knowledge to the farmers and implement nursing and thinning soon because the time of the ex-post evaluation coincided with the time when the forests needed thinning.

Regarding the response to the case of emergency such as mountain fire, state owned forest farms prepared patrolling shifts and manuals. The state farms, from the view point of forests protection, are also prepared to respond to the fire in neighboring farmers’ forest. Farmers employed their own forest patrol individually, but no manual or maintenance reports existed.

Not only the farmers but also the local engineers had inaccurate knowledge on forest maintenance, and did not implement appropriate young forest nursing and thinning. Additional training and technical guidance would be desirable because some problems were observed in technical sustainability.

3.5.3. Financial Aspects of Operation and Maintenance

According to the provincial forestry bureau’s project office, the forestry budget

increased year by year, and, in 2012, became more than five times the 2004 budget. At the county level, the independent foreign-funded afforestation budgets decreased because the project offices were gradually assigned other sections' work as well. However, the budgets for forest maintenance and fire, disease and pest control were secured at the provincial level, and distributed to the county (city and district) level based on the needs. Therefore, necessary amounts were secured every year.

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 country bureau level was distributed from the province based on the needs, and the necessary amount was secured every year.

Table 14: Annual Funding for Forestry and the Sources (unit: 10,000 yuan)

Year	Annual Funding	Budget from National	Domestic Loans	Foreign Investment	Self -raising funds	Other Funds
2004	137,207	79,187	15,189	15,792	6,093	20,946
2005	103,703	64,635	10,375	8,395	6,360	13,938
2006	164,764	104,747	10,805	20,216	8,237	20,759
2007	132,861	93,786	6,307	7,763	10,937	14,068
2008	269,632	153,068	38,691	8,504	7,488	61,881
2009	339,813	161,587	18,702	4,976	18,009	155,241
2010	472,986	203,121	3,000	2,016	56,215	208,634
2011	570,649	373,401	14,585	7,487	66,893	108,283
2012	763,176	499,087	32,856	12,119	141,008	78,106

Source: Jiangxi Province Statistical Yearbook (2013)

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 Timber (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.

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. Since 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 15: Loan and Repayment Status

Total Loaned Amount	Rate	Starting date for Repayment	Amount Repaid
100,476 yuan	0.75 %	March 2014	3,782 yuan

Source: Beneficiary Survey

Repayment has started from March 2013. At the time of the ex-post evaluation, repayment for one to two times have completed. The average amount per repayment was 3,782 yuan, and problems such as delinquency or insolvency have not occurred. If implementation bodies were unable to pay back the loan, the provincial (or city or county) 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 the survey to the engineers (Table 16), with regard to the condition of their forests, 87% answered “fine,” while 13% said “there are a few problems.” Among the cited were “the survival and preservation rates were low,” “forest diseases and pests occurred,” “production amount is low,” “fertilizer amount is insufficient,” and “the forest suffered damage from a natural disaster.” Regarding the maintenance status, 80% thought that it was “fine” while 20% answered that “there are a few problems.” The reasons for the problems were “shortage of maintenance budget,” “shortage of manpower for maintenance,” “periodical maintenance was not provided,” and “frequent natural disasters prevent continuous maintenance.”

Table 16: Result of Survey to the Engineers on Forest Maintenance (38 samples)

How is the condition of the forest?		How is the status of forest maintenance?	
Fine	87 %	Fine	80 %
There are a few problems.	13 %	There are a few problems.	20 %
There are many problems.	0 %	There are many problems.	0 %

In the beneficiary survey on the forest condition (Table 17), 90% of the respondents said that the condition of their forests was “fine” while 3% said that “there are a few problems.” They said that the main cause of the problems was “insufficient nursing.” About the status of forest maintenance, 94% of the respondents considered it “fine” and 2% said “there are a few problems.” The problems cited include “insufficient manpower” and “lack of funds for maintenance.”

Table 17: Result of Beneficiary Survey on Forest Maintenance (100 samples)

How is the condition of the Forest?		How is the status of forest maintenance?	
Fine	90 %	Fine	94 %
There are a few problems.	3 %	There are a few problems.	2 %
There are many problems.	0 %	There are many problems.	0 %
Not answered.	7 %	Not answered.	4 %

About the forest condition, 13% of the engineers were aware that there were a few problems while only 3% of the implementation bodies had the same perception. Regarding the forest maintenance status, 20% of the engineers thought that there were a few problems, but only 2% of the implementation bodies did. Thus there was a perception gap between the engineers and the implementation bodies on the problems in the forest and maintenance status. It is possible that the implementation bodies did not grasp the existence of problems in forest maintenance.

As mentioned in the passages on technical aspects, the forest maintenance status needed improvement. Technical transfer on disease and pest prevention and control, nursing, and thinning was insufficient. In addition, accurate knowledge on nursing and thinning was lacking. The provincial government already started addressing these problems, but it is necessary to strengthen training and technical guidance and implement appropriate maintenance tasks such as nursing and thinning.

(2) Sustainability of the Project's Effects in Longer 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 18, the actual fell has been less than 30% of the annual allowable cutting amount allocated to the province by the national government. The Jiangxi 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 18: Annual Allowable Cut and Actual Fell (unit: 10,000 m^3 /year)

	the 10th Five-Year Plan (2001-2005),	The11th Five-Year Plan (2006-2010),	The12th Five-Year Plan (2011-2015),
Allowable Cut	1,529	1,815	1,997
Fell	About 30% of the annual allocation		663 m^3/year in 2014 (33.2 % of the upper limit)

Source: Jiangxi Province Forestry Bureau Foreign Funds Afforestation Project Office.

The project plan recommended building mixed forests with multiple species for ecological environment conservation, but the vast majority of the forests ended up as simple ones. If an outbreak of forest diseases or pests occurs, simple forests

have a higher risk of spreading the damage to the same species and varieties. However, according to the provincial forest bureau, it had the system to control diseases and pests depending on the damage, and took preventive measures according to the severity of the damage. Therefore, no problem was found that would have a negative impact on the sustainability of the effects of the project, and it is fair to say that, given the current status, the risk that any problem will be out of control is low.

(2) Operation and Maintenance of Facilities and Equipment

The project constructed the training center within the premises of the Jiangxi province Forestry Bureau. Since the project completion, the center has been used for 100 meetings and training sessions a year. The Jiangxi Province Forestry Bureau Service Center undertakes all the maintenance work of the training center.

All the office equipment (87 pieces) and environment monitoring devices (22 pieces) were installed in the city forestry bureaus, county project offices, and forestry farms. The installation sites bought a few new equipment and devices at their own expense to replace the ones that exceeded their service life.

Nursery facilities including irrigation systems were built at four nurseries and Ji'an Forestry Science Technology Model Garden, and each institution maintains the facilities on its own. At the time of the ex-post evaluation, the nursery houses completed their functions and were dismantled because they were simple ones like plastic greenhouses.

Forty vehicles, eight motorcycles, and four farm vehicles were used and maintained at the institutions where they were delivered such as forestry bureaus, project offices, and state-owned farms. The vehicles were maintained regularly and no problem such as breakdown did occur.

The training center built in the project, the nursery facilities and equipment installed, and the vehicles delivered were used for the purposes intended at the time of the appraisal.

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 mentioned above, some minor problems have been observed in terms of technical, financial aspects, and the operation and maintenance status. Therefore sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1. Conclusion

The Jiangxi Province Afforestation Project aims to improve the quality of forests in Jiangxi Province, and to 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 positive one for assuring forestation and for setting the sustainable system for forest management, while benefitting the small-scale farmers. By contrast, a problem at the time of the appraisal is that erosion control effects by forest type were not examined. The afforestation plan should have been drawn in accordance with the flood and erosion damages based on examination of effects. 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 planted trees in the area equivalent to 18% of the water and soil erosion control area of Jiangxi Province between 2004 and 2012, and contributed to improving the forest coverage ratio and forest stock volume. The forests are still growing but expected to bring about economic impacts in the future. However, because tree planting and forest management did not follow the afforestation design, the improvement in the quality of forests and ecological conservation effects are limited. Thus the effectiveness and the impacts 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 forests 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 of the Project were secured by subsidies and 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 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' 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, has started additional training and guidance for farmers, needs 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.

Afforestation of protection forests (four-side afforestation) is encouraged for the greening of the province. Trees were often damaged by human undertakings with malicious intent especially in farmlands used for afforestation because the planted trees hindered the convenience of farm work and the trees took nutrients away from the soil and affected the growth of farm products. To address this problem, it is necessary to strengthen the management of farmlands and devise measures to avoid conflicts with farmers who offer farmlands. In the sites visited by the evaluation team, the following measures are possibilities: the landscaping firms responsible for maintaining forest lands issue warnings to the farmers about the tree damages; including in the land rental contract provisions on tree protection to avoid trouble in advance; or making the rental contract provisions favorable for the growth of farm products.

4.2.2. Recommendations to JICA

None

4.3. Lessons Learned

(1) <u>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.</u>

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 to not only 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) <u>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.</u>

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. 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.

(4) To sustain the effects of afforestation in the long term, while making the project plan, JICA and the executing agency need to examine carefully the maintenance costs after the project completion.

In the plan at the time of the appraisal, the completion of the project was defined as acceptance upon inspection in the third growth year, and the maintenance afterwards was entrusted to the implementation bodies. The timing of the ex-post evaluation was five to eight years after planting, and the implementation bodies were responsible for maintenance. However, in most of the project sites, appropriate nursing and thinning for young trees were not provided. This was partly because accurate knowledge on nursing and thinning was not disseminated among not only the farmers but also the engineers who were to guide them. However, the main cause was the shortage of the maintenance budgets. Lack of nursing for young growth forests was a pressing problem in China as a whole. The Chinese government set up a new subsidy for nursing Ecological Forests, but it was not used much for the project forest sites because the subsidy's target areas were limited. In the plan at the time of the appraisal, implementation bodies were to have covered the maintenance costs by income from

the forests, and such maintenance budget shortage was not envisaged. At the planning stage of similar projects in the future, JICA and the executing agency need to examine the work plan according to the maintenance needs in the mid- to long-term perspective, and to consider the maintenance costs after the completion of the project based on the relevant government's policies and the existence of subsidies.

END.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
Afforestation	219,203 ha	235,890 ha
Timber Forest	65,637 ha	87,389 ha
Economic Forest	5,350 ha	2,077 ha
Protection Forest	148,180 ha	146,424 ha
Mountain Closure	52,167 ha	42,411ha
Afforestation Material		
Seedling	167.97 million	370.84 million
Seed	151.8 ton	Import 3.43 ton Domestic N/A
Fertilizer	20,498 ton	Cancelled
Facilities and Equipment		
Vehicle		
Forest Monitoring Vehicle	44	40
Motorcycle	90	8
Farm Vehicle	None	4
Office Equipment	167 pieces	87 pieces
Environment Monitoring Tools	36 pieces	22 pieces
Nursery Facility		
Small (350m^3)	5 places	3 places
Middle (600m^3)	5 places	Canceled
Large (800m^3)	2 places	2 places
Irrigation	30 hm^2	20 hm^2
Sprinkler	3 sets	1 set
Battery for nursery	3 sets	As planned
Construction	6,446 m^2	3,000 m^2
Dam	None	2,500 m
Leveling	None	70 hm^2
Training Center	4,000 m^2	built in the premises of the provincial forest bureau
Training		
Overseas Training	3 times 60 persons	3 times 45 persons
Province (Manager/Engineers)	N/A	15 times 1,560 persons
City (Manager/Engineers)		21 times 150 persons
County(Manager/Engineers/ Forest Farm Engineers/ participants)		186 times 25,000 persons
Technical Guidance (participants)	N/A	29,000 persons
2. Project Period	March 2004 -December 2009 (70 months)	March 2004-June 2012 (95 months)
3. Project Cost		
Foreign currency	206 million yen	2,851 million yen
Domestic currency	9,859 million yen (766.6 million yuan)	7,211 million yen (240.8 million yuan)
Total	10,065 million yen	10,062 million yen
Yen loan	7,507 million yen	7,506 million yen

Exchange rate	1 yuan=14.3 yen (as of September 2003)	1 yuan=13.623 yen (the average rate used by the executing agency 2005-2012)

Attachment: Growth Situation in the Project Sites

1. Protection/Timber Forests

1-1 Simple/Mixed Forests (Species: Chinese fir, Slash pine and others)

- The main species employed were Needle-leaved trees (Chinese fir, pine), which occupied 70% of all the forests. While broad-leaved trees (liquidambar, oak, paulownia, Chinese tulip trees) occupied 20%, and other species 10%. At the time of the ex-post evaluation, the average preservation rate was 96.4%, and all the Project sites exceeded the target for the third growth year. Protection Forests and Timber Forests were not distinguished because the former were grown practically as the latter.
- The main species, Chinese fir and pine planted in the Project sites were growing normally. The average height, circumference and the stock volume of Chinese fir forests between 5^{th} to 9^{th} growth-year, measured as 7.2m, 8,3cm and 4.400m^3/mu. Also the average size and the stock volume of Slash pine forests between 5^{th} to 10^{th} growth-year measured as 6.1m, 9.7 cm, 5.579m^3/mu. It is predictable that 20 to 25 years after the planting the forests of the species are to be ready for cut as timbers. The Jiangxi province has climate and precipitation favorable for afforestation, thus high income from thick timbers can be expected. Pine trees produce resin from 7^{th} growth-year, which also yield high economic effects.
- The evaluation team found that thinning and young forest nursing were not executed in proper frequency, also weeds in the forest beds and density were not maintained in appropriate condition. According to the forest design at the Project plan, the adequate density at planting was 146 plants/mu, then in 8^{th} growth year, the density should be reduced to 106 plants/mu by thinning. In reality, the average density of the Project sites was 193 plants/mu in the forests of Chinese fir, and 161 plants/mu in the pine forests, which were higher than the adequate standards.
- 95% of the Project sites ended up to be simple forests. Simple forests have contributed less to the intended biodiversity. Also, their durability to diseases and pests is lower than the one of mixed forests. Thus the contribution to the Project's aim, restoration of the multi-dimensional functions of forests, ended up to be limited.

Measured data of Simple Forest (Species: Chinese fir)

Species	Tree Age (year)	Preservation Rate (%)	Height (m)	Circumference (cm)	Density (#of tree/mu)	Stock Volume (㎥/mu)	Note
Chinese fir	5	100.0	5.0	6.2	167	2.664	
	6	100.0	6.4	8.1	296	3.507	
	7	98.4	7.9	8.4	195	4.946	
	8	95.3	7.1	9.6	167	4.426	
	9	100.0	9.6	9.2	142	6.456	
Average	5-9	98.7	7.2	8.3	193	4.400	

Measured data of Simple Forest (Species: Slash pine)

Species	Tree Age (year)	Preservation Rate (%)	Height (m)	Circumference (cm)	Density (#of tree/mu)	Stock Volume (㎥/mu)	Note
Slash pine	5	100.0	5.1	7.1	166	1.992	
	7	100.0	5.3	9.5	166	4.974	
	8	90.6	5.1	10.0	167	3.507	
	9	95.0	7.8	11.0	166	7.464	
	10	90.5	7.4	11.0	140	9.960	
Average	5-10	95.2	6.1	9.7	161	5.579	

Measured data of Simple Forest
(Species: Empress Tree, Masson's pine, Japanese Oak)

Species	Tree Age (year)	Preservation Rate (%)	Height (m)	Circumference (cm)	Density (#of tree/mu)	Stock Volume (㎥/mu)	Note
Empress tree	6	85.0	8.0	12.9	111	5.001	Protection Forest (four-side afforestation)
Masson's pine	10	90.0	8.2	10.5	111	3.596	Mountain Closure
Japanese Oak	10	—	13.8	16.9	111	14.306	Natural broad-leaved. Young forest nursing

Measured data of Mixed Forest
(Species: Chinese fir, Slash pine and others)

Species (ratio)	Tree Age (year)	Preservation Rate (%)	Height (m)	Circumference (cm)	Density (#of tree/mu)	Stock Volume (㎥/mu)	Note
Chinese fir (7)	4	100	3.5	4.5	117	0.266	
Slash pine (3)		100	2.8	4.4	50	0.952	
Chinese fir (8)	9	100.0	6.5	8.1	133	1.987	
Slash pine (2)		95.0	9.0	10.9	34	2.25	
Chinese fir (7)	10	85.0	7.6	9.2	96	2.592	
Chinese tulip tree (2)		100.0	9.7	9.6	40	1.200	
Liquidambar(1)		100.0	9.9	9.3	21	0.630	
Slash pine (6)	10	100.0	9.7	10.2	78	2.586	
Liquidambar(4)		100	9.2	9.3	60	1.53	

Model Forests Reference Data for Simple Forests

Species	Tree Age (year)	Preservation Rate (%)	Height (m)	Circumference (cm)	Density (#of tree/mu)	Stock Volume (m^3/mu)	Note
Chinese fir	20	88.0	15.6	20.8	78	20.28	
Slash pine	23	—	14.8	18.1	78	13.416	Producing resin

1-2. Simple/ Mixed Forests (Species: Bamboo)

・Majority of the bamboo forests became simple forests. Broad-leaved trees mixed partially in some bamboo forests.

・Bamboo forests were maintained in good condition. Twice in a year, the implementation bodies dug the ground for the purpose to soften the forest beds. The forests were fertilized, and controlled the density appropriately.

・Bamboo forests (8^{th} growth-year) yielded 25 bamboos/mu as industrial material. Also the same forests yielded edible bamboo shoots in a stable manner, which amounted 100 kg/mu in winter season and in 350 kg/ mu spring season.

・Heavy snow damaged 90% of the bamboo forests area. Supplemental plantation executed at 59 bamboo/ mu in 2008. In 2014, the forest restored to the level at 200 bamboo/mu. In order to restore the damaged bamboos, the implementation bodies took measurements such as nutrition injection and pouring fertilizer into bamboo stumps.

1-3. Simple Forest (Four-side afforestation, Species: Populous)

・Empress tree and poplar were the main species. Landscape companies planted and have been maintaining the four-side afforestation sites. The road side trees were planted in farm lands located on the both sides of an arterial road. The afforestation area (30m width) were borrowed from farmers. The farmers preferred to use the lands for farming rather than renting for afforestation because the trees were obstructions for farming, also trees take nutrition from other farm products. The trunks were bound with wires and the growth were disturbed. There were similar human activities damages reported at other four-side afforestation sites. To address this problem, it is necessary to strengthen the management of farmlands and devise measures to avoid conflicts with farmers.

2. Mountain Closure (Species: Masson's Pine)

・Before the implementation of the Project, farmers cut the trees for fuel, thus the growth of trees in the area was disturbed. After the Project started in 2005, the state owned forestry farms have been blocking the area and prohibiting tree cutting. Also

the farms executed aerial spread of seeds, and planted Masson's pine seedlings.

- At the time of ex-post evaluation, the area did not yield any forestry products, but in 5 to 10 years, the pine trees would be cut for timbers.
- The Project site used to be heavily damaged area by erosion. Since implementation of the Project, the plant coverage ratio improved from 20% to 40%, it is fair to say that the Project contribute to reduce the erosion damage significantly.

END.