People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan
"Gansu Afforestation and Vegetation Cover Project"

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0. Summary

The Gansu Afforestation and Vegetation Cover Project (hereinafter referred to as the "Project") aims to improve the forest and vegetation coverage ratios by afforestation and crop planting for preventing desertification, and contribute to social and economic stability. The Project was prompted by the increased importance of afforestation because of the escalation of desertification in China. The relevance of the Project is high because the Project is consistent with the Chinese government's policies, development needs, and Japan's aid policy. For further contribution to desertification prevention in areas with the severe natural environment, the main Project implementation bodies for Economic Forests changed from small-scale farmers to groups of farmers or enterprises, and those for Protection Forests and Closure changed to local governments or state-owned forest farms that act for the public interest. The change was sound for implementing afforestation and crop planting in a more effective area on a larger scale and sustaining the operation and maintenance system while also benefitting the small-scale farmers. The Project's afforestation and vegetation area, equivalent to 63% of the desert decreased in the same period in the entire Gansu Province, contributed to desertification prevention. At the time of the ex-post evaluation, trees and grasses were growing well, and the Project helped increase the production of forest products and income, and improve the living environment. Thus the effectiveness and impacts of the Project are high. With regard to the efficiency, the project period was within the planned limit, although the project cost exceeded the plan because of the additional afforestation and vegetation area. Thus the efficiency of the Project is fair. The exclusive project office for the yen-loan project was dissolved, but no problem was seen in the institutional aspects of sustainability because the Gansu Provincial Government Finance Bureau Agricultural General Development Office, an upper-tier office, took over the office's functions. The budget for operation and maintenance was secured by a subsidy from the national government, and the budgets of the finance and forestry bureaus and the local government. Some farmers needed improvement because of insufficient technical transfer and lack of forest and irrigation facility maintenance. However, both the technical aspects and the operation and maintenance status in most of the forests and grasslands were generally favorable. Therefore the sustainability of the Project is high.

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

1. Project Description

Project Location

Photo 1: Economic Forest of grapes where drip irrigation facilities were equipped (Gansu Province Jiayuguan city)

1.1. Background

In China, nearly 30% of the national territory was a desert or faces the risk of desertification as a result of major deforestation, excessive cultivation and grazing accompanying the the country's rapid economic growth. The damage by the sand and dust storms coming from the desert areas have been increasing year by year; in May 1993, 85 people died, and 120,000 head of livestock were lost in four provinces and autonomous regions. Yellow sand and dust from the deserts reach the other countries in East Asia.

Shortly after the devastating flood in 1998, in response to the flood and the major natural disasters above, the Chinese government implemented the National Plan for Ecological Construction. The plan set four priority projects[1] for natural environment improvement, target areas and numerical targets, and prepared the development of systems for improving the ecological environment as well as large-scale afforestation projects.

Gansu Province was part of all the target areas[2] including the "Desertification area." At the time of the appraisal, the forest coverage ratio of the province was much lower than the national average. The vegetation coverage ratio in Hexi Corridor, where it has an extremely small amount of precipitation, decreased significantly because of artificial elements such as waste of water resources, excessive logging and cultivation. Under such circumstances, the Gansu Provincial government requested the Japanese government for an afforestation and vegetation project with yen-loan to increase the forest and vegetation coverage ratios and improve the living environment by preventing desertification. The Japanese government approved the request.

[1] Projects related to erosion control, preventing desertification, increasing forests area, and increasing forest coverage ratio.

[2] ①Upper and middle basin of the Yellow River; ②Upper and middle basin of the Yangtze River; ③ Desertification area; ④Grassland area

1.2. Project Outline

The objective of this Project is, through afforestation and crop planting, to raise forest and vegetation coverage, and improve the living environment by preventing desertification in the area and the one surrounding it, thereby contributing to social and economic stabilization of the Hexi Corridor area in Gansu Province.

Loan Approved Amount/ Disbursed Amount	12,400 million yen / 12,388 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March, 2003 / March, 2003
Terms and Conditions	Interest Rate 0.75% Repayment Period 30 year (Grace Period) (10 year) Conditions for Procurement: General Untied
Borrower / Executing Agency	Government of People's Republic of China / Gansu Provincial People's Government
Final Disbursement Date	October, 2012
Main Contractor (Over 1 billion yen)	None
Main Consultant (Over 100 million yen)	None
Feasibility Studies, etc.	Feasibility Study Report by Forestry Surveying and Designing Institute of Gansu Province, July 2002 Special Assistance for Project Implementation (March 2004)
Related Projects	● Ningxia Afforestation and Vegetation Cover Project (L/A 2002) ● Shaanxi Loess Plateau Afforestation Project (L/A 2001) ● Shanxi Loess Plateau Afforestation Project (L/A 2001) ● Gansu Water-Saving Irrigation Project (2000-2007) ● Dissemination of New Forestation Technology in Loess Plateau (2010-2015) ● Loess Plateau Afforestation Project (World Bank 1999-2009)

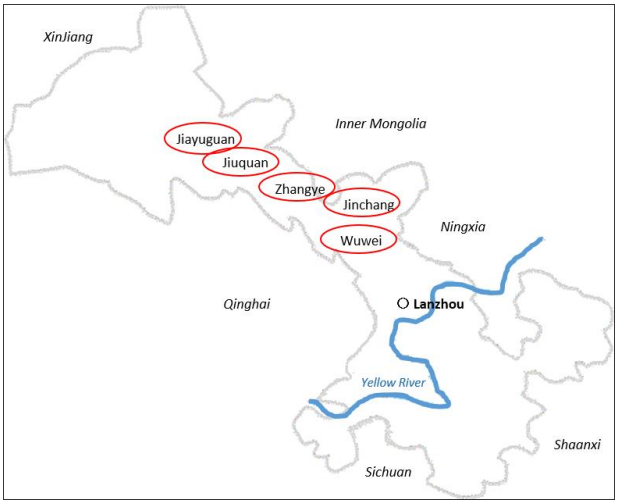

Figure 1: Project Sites in Gansu Province

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: December 5, 2014 – December 16, 2014

2nd Field Study: April 25, 2015 – April 28, 2015

2.3. Constraints during the Evaluation Study

As this ex-post evaluation was carried out 5 years after the Project completion in 2009, it was premature to observe the Project's mid- to long-term effects, and analyze future prospective conclusively. Accordingly, the ex-post evaluation focused on analyzing of basic effect indicators, prospects for the development and sustainability of the Project's effects and the status of the institutional, financial and technical environment 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 field survey[3]. Firstly, the forests were still growing and not ready for observation of their fully developed status. Secondly, the Project covered a vast area consisting of 5 cities in Hexi Corridor, and it was impossible to visit all the project

[3] The Project was implemented in 5 cities in the Hexi Corridor, which is a vast area. It was impossible to conduct a field study in all the project sites during the evaluation study period. To address this problem, the evaluation team asked the Gansu provincial government, the implementing agency, to collect operation and effect indicators in all the sites. In addition, the evaluation team chose six representative sites to conduct questionnaire, site-visit, and beneficiary surveys in order to grasp the overall picture.

sites within the allocated study period.

3. Results of the Evaluation (Overall Rating: A[4])

3.1. Relevance (Rating: ③[5])

3.1.1. Relevance to the Development Plan of China

(1) Development Policy at the Time of the Appraisal

At the time of appraisal, in the National Plan for Ecological Construction (1998-2050), the Government set four target areas for natural environment protection and restoration. Gansu Province was included in all the target areas, such as Loess Plateau Basin, Yangtze River Basin, Desertification, and Grassland.

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

Under the 12th Five-Year Plan (2011-2015), Gansu province was target of Yangtze River Basin Shelter Forest Programs to reduce soil loss, Natural Forest Resource Protection Program, and Steep Farmland Conversion to Forestland. The Gansu Province 12th Five-Year Plan (2011-2015) also set ecological environment conservation and natural environment protection as the important sources for the economic development and improving quality of life. The Gansu Province implemented policies to restore and to increase forest and vegetation coverage by Yangtze River Basin and Yellow River Basin erosion reduction, by Steep-Farmland Back to Forest and grassland programs for restoration and increasing of forest and vegetation coverage, and to promote water conservation by building ecological forest in the river basin. At the same time, the province aimed to promote forestry with local color by enhancing production of Gansu's indigenous products, also by promoting sightseeing industry by building national conservation areas and parks.

To implement the policies, the Gansu provincial government encouraged the use of foreign loans. Since the 1990s, the government has executed afforestation projects funded by the World Bank and the Government of Japan. As shown in Table 1, the Project is larger in both the afforestation area and the budget than other projects implemented around the same period. The Project contributes largely to the policies, and the implementation of the Project is relevant.

Table 1: Foreign Funded Afforestation Projects

Project	Donor	Duration (year)	Afforestation Area (ha)	Cost (10 thousand US Doller)
Forestry Development Project	World Bank	2003-2011	2,582	364
Ecological Afforestation Project	Korea	2001-2006	1,540	288
The Project	Japan	2003-2010	136,000	13,833

Source: Gansu Provincial Government Finance Bureau Agricultural General Development Office

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

[5] ③: High, ② Fair, ① Low

3.1.2. Relevance to the Development Needs of People's Republic of China

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

At the time of the appraisal, the forest coverage ratio in Gansu Province was 9%, which was lower than the national average of 17%. Hexi Corridor has a very small amount of precipitation. In addition, artificial causes such as waste of water resources, deforestation, and excessive cultivation decreased the vegetation coverage in the area. To address the situation above, the Gansu Provincial People's Government took such measures as restrictions on grazing, but the desertification came near the irrigation and residential areas and threatened people's daily lives.

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

At the time of the ex-post evaluation, the forest coverage ratio in Gansu province was 13.42%, which was lower than the national average of 20.36%[6]. The annual average precipitation in the province was around 300 mm/year, but the evaporation amount was between 1,259 and 3,522 mm/year, greatly exceeding the precipitation. Moreover, the altitude of the province is between 1,000 and 3,000 m[7]. Because of such severe environment, the desert area of the province reached 192,100 km^2, which was the fourth in the nation. The province's desert area was equivalent to 7.3% of the desert area of the nation, and occupied 42%[8] of the province's territory[9]. Also, in 2012, sand and dust storms occurred 44 times[10], the highest number in the past ten years. As mentioned above, the desertification prevention was still an important agenda. The Gansu Province 12th Five-Year Plan (2011–2015) set such targets as afforestation in 1,233,000 ha increasing the forest coverage ratio to 17% or higher, and the stock volume of 6.83 million m^3 or higher by the end of 2015. Thus the development needs on desertification prevention and afforestation were high at the time of the ex-post evaluation.

3.1.3. Relevance to Japan's ODA Policy

Both the Economic Cooperation Plan for China issued by the Government of Japan in October 2001 and Japan's Medium-Term Strategy for Overseas Economic Cooperation Operations (2005–2008) gave priority to addressing global environmental issues, and cited the following means to do so: cooperation to environmental conservation, forest conservation and management. The Country Assistance Strategy for China (2002) set its main targets as environmental conservation and human resource development in the inner part of China, because environmental problems in China might have a direct impact on Japan. The Project targeted afforestation and vegetation in Gansu Province, and contributed to environmental conservation. Therefore, relevance to Japan's ODA

[6] Gansu Province Statistical Yearbook (2013)
[7] Gansu Provincial Government Finance Bureau Agricultural General Development Office (2014)
[8] National Forestry Bureau "National Desertification Situation Report"(2011)
[9] The territory of Gansu province is 451000 km^2.
[10] Gansu Province Environmental Protection Bureau "Gansu Environmental Quantity Review" (2010-2013)

policy is high.

3.1.4. Appropriateness of the Project Plan and its approach

At the time of the appraisal, it was expected that the main implementation bodies would be small-scale farmers, and they would plant trees and grasses in their own land[11]for ecological conservation effects and poverty reduction, improving the ecological environment by preventing winds and sand flow, and yielding economic and social effects by the income from the Economic Forests. In reality, small-scale farmers did not participate in the Project because of the very long 40-year repayment period for the loan from the county government and concerns about the economic pressure. Eventually, large-scale farmers, groups of farmers, and enterprises became the main implementation bodies for Economic Forests, and the afforestation area[12] per implementation body became more than 10 times the original assumption.

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

Protection Forests[13], Closure[14], and Engineering Sand Fixation[15] incur maintenance costs but do not generate sufficient income. Thus the executing agency did away with allocation of such areas to the farmers, and all the areas were allocated to the bodies for the public interest such as state-owned forestry farms and erosion control station. By changing the implementation bodies to public agencies, afforestation and planting were executed in the most effective locations for the whole district on a larger scale, enabling the Project to benefit a larger population.

The Project was highly relevant to the development policies of the Chinese and Gansu Provincial governments, their development needs, and Japan's ODA policy. The main

[11] At the time of the planning, it was anticipated that the average forest area per implementation body would be 0.86 ha, and 50,250 farming households would participate in the Project.
[12] According to the beneficiary survey with 100 samples, the average area per implementation body was 12.4 ha.
[13] The documents provided by JICA state that sand fixation by shrubbery procurement and plantation, and building windbreak forests. Gansu Province uses the term "Ecological Forest" throughout from the time of the Feasibility Study. The Japanese side considered that the forests consisted only of shrubbery, but the Chinese side divides the Ecological Forests into the categories of Arbores (e.g., Poplar) and Shrubbery (e.g. Locust, Saxaul). The Forestry Law of China uses the term "Sand-Fixing Forest."
[14] Closure is a method to protect forests. According to the Forestry Law of China, the method is to restore the vegetation by sealing off half or all of the target area to prohibit logging for energy and the entry of livestock.
[15] A technique to fixate a sand dune and prevent the movement and flow of the sand by making a lattice called "square grass frame" by mixing straw and mud and burying it in the surface of a desert, then planting shrubbery in the frame.

implementation body was changed to increase the Project's effectiveness and sustainability while providing benefits to small-scale farmers who were planned at the time of the appraisal to be the main implementation body. Therefore the relevance of the Project is high.

3.2. Efficiency (Rating: ②)

3.2.1. Project Outputs

At the time of appraisal, the Project's envisioned outputs consisted of afforestation, materials, vehicles, irrigation and road construction, facilities and equipment, and training/technical guidance. Table 2 shows the plans and the results of the outputs of the Project.

Table 2: Output

Item	Plan (Target year 2010)	Actual (Project completion 2009)
Afforestation		
Afforestation	**91,072 ha**	**136,472 ha**
Protection Forests	16,204 ha	23,825 ha
Arbores	3,471 ha	7,900 ha
Shrubbery	12,734 ha	15,975 ha
Economic Forests	18,264 ha	20,758 ha
Grape	5,042 ha	4,847 ha
Jujube	1,658 ha	1,821 ha
Hop	770 ha	2,626 ha
Fruits mixed	810 ha	1,300 ha
Alfalfa	9,988 ha	10,164 ha
Closure Afforestation	51,106 ha	86,284 ha
Engineering Sand Fixation	5,493 ha	5,604 ha
Afforestation Material		
Seedling	190.5 million	247.65 million
Chemical Fertilizer	12,993 ton	19,739 ton
Organic Fertilizer	113,942 ton	147,367 ton
Pesticide	682 ton	863 ton
Facilities and Equipment		
Canal	1,110 km	1,202 km
Irrigation	8,978 ha	9,317 ha
Impoundment	780 m^3	4,780 m^3
Road construction	845 km	1,134 km
Electric Line	20.8 km	As planned
Transformer	8 sets	As planned
Construction	13,280 m^2	13,560 ㎡
Farm Machinery	894 sets	949 sets
Vehicle	125	99
Motorcycle	217	12
Truck	35	As planned
Environment Monitoring Tools	350 pieces	322 pieces
Training		
Training (Project Managers /Engineers)	30 persons	As planned
City Government	3,610 persons	6,710 persons
County /Township Government	1,030 persons	1,365 persons
Gansu Farms Agribusiness Corp[16]		
Technical Guidance(participants)	23,800 persons	34,500 persons

Gansu Provincial Government Finance Bureau Agricultural General Development Office

(1) Afforestation

The actual afforestation area was 136,472 ha, which was 150% of the planned area of 91,072 ha. Along with the change in implementation bodies, the area by forest type was modified, and afforestation areas increased in all the forest types. However, Economic Forests of grapes decreased to 96% of the planned area due to the economic reasons such as the decrease in grape prices since the time of the appraisal, and the higher costs of grape planting compared to other crops because of such facilities as stakes. The area reduced was

[16] Gansu Farms Agribusiness (Group) Corporation had been the provincial government agriculture development bureau that was responsible for supervising farms directly; in 1978, it was converted to a company along with the farms under its supervision. Under the Project's institutional structure, it was equivalent of the city government level.

converted to other products that would generate profits. Thus the change brought no negative impact on outputs.

Protection Forests, Closure, and Engineering Sand Fixation were considered afforestation projects for the public interest. The total areas of these afforestation projects increased because local governments and state-owned farms took the lead in implementing them in the areas where sand and dust flew from deserts. While the allocation of Closure and Engineering Sand Fixation for the farmers decreased, the one of Economic Forests was increased proactively.

(2) Afforestation Materials

Along with the increase of the Economic Forests and Protection Forests areas, the consumed quantity increased in seedlings (130% of the plan), fertilizer (chemical: 152% of the plan; organic: 129% of the plan), and pesticides (127% of the plan), respectively. The government procured seedlings, fertilizer, and pesticides in bulk, and distributed them to the implementation bodies upon presentation of the afforestation passbook.

(3) Facilities and Equipment

① Facilities and construction

Facilities were mostly procured as planned. The total capacity of reservoirs was 613% of the plan because the Zhangye city government increased its financial input to build a reservoir of 4,000 m^3 as a new water source for increasing Economic Forests of jujube in Linze county. As public works, Protection Forests, Closure, and Engineering Sand Fixation were mainly built in the areas where a large amount of sand and dust flew from the desert. Access roads to the areas constructed because the areas were remote. Thus the total length of constructed roads amounted to 1,134 km, which was 134% of the plan.

② Vehicles

The needs for vehicles were reassessed after the Project started because some vehicles and motorcycles that had been purchased by other projects existed. Then the number of vehicles to purchase was decreased.

(4) Training and Technical Guidance

① Training for Project Managers and Engineers of Local Governments

In the training for project managers and engineers of local governments (city, county/township, Gansu Farms Agribusiness Corp.), the number of potential trainees increased significantly, and 8,105 people in total, or 174% of the plan, took the training. The reason for the increase is that the afforestation of forests in the public interest became a public works project. The training subjects for the project managers included the following: project and financial management; desert ecological environment management; water resource management; and project inspection. For engineers, the training covered the

following subjects: water-saving irrigation; biological and Engineering Sand Fixation; desert afforestation techniques; cultivating indigenous products of Economic Forests; artificial grassland creation, production and processing; aerial dispersion; and arid land afforestation.

② Technical Guidance for Implementation Bodies

For the implementation bodies who took part in the Project, county and township engineers provided technical guidance. The number of trainees was 34,500, which was 145% of the planned 23,800 because implementation bodies to build forests as public works increased. The training subjects were as follows: water-saving irrigation including drip irrigation; biological and Engineering Sand Fixation; fruit tree production in Economic Forests; and artificial grassland creation and management.

③ Other Training Courses

The Project implemented no training in Japan. However, during the Project implementation, 14 project office managers and engineers at the province, city, and county levels took part in JICA's "Training on Water-Saving Irrigation Technology." In addition, two managers of the provincial project office participated in JICA's "Capacity Building Training for Forestry Managers." The outputs of the two JICA training courses were reflected in the Project's training and the implementation.

At the time of the appraisal, the prospective main implementation bodies were small-scale farmers with forests for afforestation of about 1ha per implementation body. However, for Economic Forests, groups of farmers or large-scale farmers implemented the Project in more than ten times the planned area[17] per implementation body. In addition, public institutions implemented afforestation in the ecological forests such as Protection Forests, Closure, and Engineering Sand Fixation. As a result of the change, the total afforestation area increased to 150% of the plan, and the plans on afforestation materials, facilities and construction were modified. In the procurement of vehicles and environment monitoring devices, the revision in the necessary amounts helped reduce the costs. Thus the changes in the outputs were appropriate.

3.2.2. Project Inputs

3.2.2.1 Project Cost

The planned total Project cost was 16,600 million yen (of which the ODA loan portion was 12,400 million yen). The actual cost was 16,933 million yen[18] (of which the ODA loan portion was 12,388 million yen), which exceeded the plan slightly (102% of the planned amount[19]). In

[17] According to the result of the beneficiary survey, the average area per farmer was 12.4 ha, which was 14 times more than the original plan i.e., 0.86 ha.

[18] The average exchange rate during the Project period, i.e., 1 yuan = 14.19588 yen, was calculated from the monthly average rates between January 2004 and December 2009. The data were obtained from the Pacific Exchange Rate Service provided by the University of British Colombia.

[19] The executing agency did not provide the detailed costs for the increase and decrease of all the individual outputs (including all forest types). Thus the evaluation team was unable to analyze if the costs were appropriate to the

the total Project cost, the afforestation cost increased because of the expansion of the afforestation area. The planned afforestation cost was 10,464 million yen as opposed to the actual one at 12,477 million yen, i.e., 119% of the planned one. The increased areas were mostly Mountain Closure and Protection Forests with relatively low planting costs. In addition, farms for grapes, a costly crop to plant, were converted to those for jujube or other less costly fruits. Thus the increase in the Project cost was kept to a minimum.

3.2.2.2 Project Period

At the time of the appraisal, the planned Project period was 92 months from March 2003 to October 2010[20]. The actual Project period was 80 months from March 2003 to October 2009, i.e., 87% of the planned one. The frost in 2005 and the low temperature in 2008 damaged Protection and Economic Forests[21], and supplemental planting was done. In the inspection in October 2009, all the areas passed as planned, and the Project was completed within the planned period.

3.2.3. Results of Calculations of Economic Internal Rates of Return

At the time of the appraisal, the economic internal rate of return (EIRR) of the Project was not calculated because the main objective of the Project was desertification prevention, and the method to calculate the EIRR in a way that suited the Project did not exist. This ex-post evaluation does not implement an analysis based on the EIRR because it was not calculated during the Project execution either.

As mentioned above, the Project period was within the planned limit, but the Project cost was more than planned. Therefore, the efficiency of the Project is fair.

3.3. Effectiveness[22] (Rating: ③)

The main component of the Project was afforestation. Therefore, the Project's effectiveness was to be evaluated by the quantitative indicators set at the time of the appraisal, forest condition based on the field studies, forest coverage ratio, and stock volume. Expected impacts were "improvement of the living environment by desertification prevention," and "contribution to the area's social and economic stability." The former was judged by the size of the desertification area and the reduction in the damage from sand and dust storms; the latter by Economic Forests' production amount and sales prices, and Project participants' income change. Incidentally, because training was not a main component of the Project, its effects were to be

output changes. Sub-rating of the Project cost followed the JICA ex-post evaluation reference by comparing the planned total Project cost and the actual one. Based on the sub-rating standard (more than 100% and less than 150% of the plan), the evaluation team determined that it was ②.

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

[21] Total damaged area of Protection Forests was 8,677ha, of Economic Forests 7,553ha. In total, 8,468,000 seedling planted supplementary.

[22] The rating for Effectiveness is to be made in consideration of Impact.

evaluated in the technical aspect of operation and maintenance in the section on sustainability, but not in the sections on effectiveness or impact.

3.3.1. Quantitative Effects (Operation and Effect Indicators)

(1) Survival Rate and Preservation Rate[23]

The survival rate and preservation rate targets at the time of the appraisal were achieved in all the afforestation types (Table 3). In the inspection in the first growth year, the survival rates were lower than the target values at four Protection Forest sites[24] and two Economic Forest sites[25]. At the sites, the implementation bodies executed supplemental planting. In the third year inspection, all the sites achieved the target preservation rates.

A local forestry expert cited the following reasons for the high survival and preservation rates despite the severe natural environment: ① appropriate sand prevention measures were taken; ② at the time of the planting, techniques such as soil exchange and frozen ground transplanting were applied and allowed the seedlings to retain sufficient water in the roots; ③ water was appropriately supplied by canals and drip irrigation after the planting; ④ forests were protected by fences that prevented damages from the entry of people and livestock; and ⑤ species and varieties that matched the areas were selected.

Table 3: Target and the result of survival and Preservation ratios

	Target at Appraisal (2003)				Result at Completion(2009)			
	Protection Forest	Economic Forest	Closure	Grassland Creation	Protection Forest	Economic Forest	Closure	Grassland Creation
Survival rate 1st growing year	85 %	85 %	None	40 %	89.4 %	91.4 %	33.8 %	96.0 %
Preservation rate 3rd growing year	65 %	85 %	30%	80 %	84.6 %	95.4 %	36.5 %	97.9 %

Source: Gansu Provincial Government Finance Bureau Agricultural General Development Office
Note: The survival/ preservation ratio of fencing closure area was measured by the ratio of shrub trees.

[23] 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.
[24] Wuwei City Gulang county, Jinchang City Jinchuan district, Jiuquan city Guazhoudistrict, and Linze farm.
[25] Wuwei City Su wushan forestry farm, Zhangye city Sunan county

Photo 2: Protection Forest build around the artificial lake in the center of the city. (Gansu Province, Jiayuguan city)

Photo 3: Closure site (Gansu Province, Jinchang city, Jinchuan distrct

(2) Forest and Vegetation Coverage Ratios

As shown in Table 4, both the forest and vegetation coverage ratios in the Project sites achieved the targets set at the time of the appraisal. The forest coverage ratio reached 9.77%, exceeding the target by 3.73%, and the vegetation coverage ratio was 40.64%, surpassing the target value by 18.76%.

Table 4: Forest and Vegetation Coverage Ratios

	Baseline	**Target**	**Actual**
	Appraisal (2002)	One year after Completion (2011)	One year after Completion (2010)
Forest Coverage	6.04 %	9.46 %	9.77 %
Vegetation Coverage	21.88 %	25.62 %	40.64 %

Sources: The baseline and target refer to JICA document at appraisal, the result provided Gansu Provincial Government Finance Bureau Agricultural General Development Office.
Note 1: Forest coverage ratio: Forest area for the total area

3.3.2. Growth Situation in the Project Sites

The evaluation team conducted a field study in 30 project sites in total in five cities and one Gansu Farms Agribusiness (Group) Corporation. The sites included Protection Forests, Economic Forests, and Mountain Closures. The team examined forest design, maintenance status, and preservation rates for the planted trees. In addition, the team measured the height, circumference and so on so to inspect the growth of the trees. The following is a summary of the study results. The details and measurement data of the study are in the attachment.

(1) Protection Forests

①Arbores (Poplar, Locust, Japanese Pagoda Tree, Euphrates Poplar, Willow, Spruce, Scots Pine, Russian Olive)

The preservation rate was over 75% in all the species. Arbores were planted as a windbreaker in roadsides, farm fields and the banks of waterways. The trees were mostly

growing well, and appropriate disease and pest control measures were taken. Almost all the sites were mixed forests. Mixed forests in parks were formulated by putting together simple forests of multiple species because the parks were meant to display the trees.

②Shrubbery (Chinese Tamarisk, Saxaul, *Hedysarum scoparium, Caragana intermidia*)

The shrubbery sites were effective in wind breaking. Local species that are suitable for desert were selected and planted. All the sites were mixed forests with multiple species. The preservation rate was higher than 73%, and the growth condition was generally good. The coverage ratio of shrubbery reached more than 30% in all the sites. Thus it is fair to say that sand flow prevention effects were generated.

(2) Economic Forests (Jujube, Grapes, Pears, Apple, Alfalfa)

The preservation rates in all the sites[26] were 85% or higher. No disease or pest damage was observed, and trees grew generally well. Regarding the maintenance status, weeding, fertilization, disease and pest control, and irrigation system maintenance were appropriately executed. A few farmers cultivating jujube and pears had problems in implementing such maintenance tasks. Other farmers selected varieties that were unsuitable for dry and cold areas such as apple and jujube. It would be desirable for Forestry bureau engineers to provide advice to the farmers on nursing and variety selection.

(3) Mountain Closure (*Nitraria roborouskii*, Saxaul, Chinese Tamarisk, *Kalidium gracile*, *Reaumuria soongorica*)

The vegetation coverage ratio was more than 40%. The evaluation team confirmed that, ten years after the beginning of the closure, multiple species of shrubbery and grasses grew well, and sand flow prevention effects were generated as a result of the vegetation recovery. In a few sites that were closed for 11 years, the vegetation coverage ratio was 20%, which was below the target. However, this was not a problem because irrigation facilities and wind protection forests were built near the sites to convert them into Economic Forests of apple trees.

[26] Because the field study was done in December, there were a few sites where the evaluation team was unable to visually examine or measure the growth of the trees. In the winter months from October to April, grape vines were buried underground to prevent damage from freezing. The team was unable to measure the growth of the vines. Thus the team interviewed engineers to confirm the growing status. Alfalfa had been cropped. However, by calculating the remaining stumps, the team confirmed that the coverage ratio was nearly 90%. The team was unable to visit hop planting sites, but confirmed the growth status through the interviews with the engineers, and pictures of the sites in every season.

Photo 4: Shrubbery planted for desertification prevention. (Gansu Province, Jiayuguan city)

Photo 5: Measuring the arbores planted in a Protection Forest. (Gansu Province, Jinchang city, Jinchuan district)

3.4. Impacts

3.4.1. Contribution to Improvement of the Living Environment by Desertification Prevention

(1) Impact on Desertification Prevention

As shown in Table 6, about 10 thousand ha of desert on average was reduced annually in the cities where the Project was implemented. From the time of the appraisal to the Project completion (2003–2009), 140,000 ha of desert area in total was reduced in Gansu Province (Table 5). This project reduced 87,800 ha of desert, which is equivalent to 63% of the total desert reduction in Gansu province.

The damage from sand and dust storms decreased in Wuwei and Jiayuguan cities. However, in Jinchang, Zhangye and Jiuquan cities, the damage fluctuated, and no trend was discerned (Table 7). According to the beneficiary survey (Table 8), to the question on whether the Project helped reduce yellow sand damages, 43% answered that the Project "contributed a lot," and 57% said "contributed somewhat." It is thus fair to say that the Project's contribution to living environment improvement was recognized.

The causal relationship between the prevention of sand and dust storms and the Project is unclear. However, the Project implemented 45,000 ha of afforestation, which was equivalent to 51% of the desert reduction in Hexi Corridor. In addition, as desertification prevention measures, the Project carried out 86,000 ha of Mountain Closure, and 6,000 ha of Engineering Sand Fixation. Thus it is fair to say that the Project's contribution to the desertification prevention in Hexi Corridor was not insignificant. Additionally, the results of the beneficiary survey show that the Project contributed to the improvement of the living environment.

Table 5: Desertification area in the nation and Gansu Province (unit: ten thousand ha)

	Appraisal (2003)			Project Completion (2009)		
	National	Gansu Province	Gansu ratio To the national	National	Gansu Province	Gansu ratio To the national
Desert Area	26,362	1,935	7.34 %	26,237	1,921	7.32 %

Source: National Forestry Bureau "National Desertification Gazette (January 2011)

Table 6: Changing of the Desertification Area[27] in the Project Implementation Districts

(unit: ten thousand ha)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total Area	**612**	**609**	**608**	**608**	**606**	**605**	**603**	**602**	**600**	**599**	**589**
Wuwei City	188	188	188	188	187	186	186	185	184	183	174
Jinchang City	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Zhangye city	34	34	33	33	32	31	31	31	30	30	29
Jiayuguan city	11	9.2	9.2	9.2	9.2	9.2	81	8.1	8.1	8.1	7.6
Jiuquan city	374	374	374	374	374	374	374	373	373	373	373

Source: Gansu Provincial Government Finance Bureau Agricultural General Development Office.
Note: the eight Gansu Farms Agribusiness (Group) Corps were located within the districts, this table do not have a line for the corps.

Table 7: Changing number of sand and dusts storm outbreak (unit: times/year)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Average of the Project Cities	**9.6**	**7.8**	**7.6**	**9.4**	**7.4**	**8.4**	**6.8**	**6.2**	**4.0**	**4.0**	**3.0**
Wuwei City	11	15	10	14	9	7	7	8	1	0	3
Jinchang City	2	1	2	6	6	5	3	5	3	2	1
Zhangye city	2	3	3	3	4	4	3	4	3	4	2
Jiayuguan city	24	16	16	18	12	17	9	5	5	8	5
Jiuquan city	9	8	7	6	5	9	12	9	8	6	4

Source: Gansu Provincial Government Finance Bureau Agricultural General Development Office.
Note: the eight Gansu Farms Agribusiness (Group) Corps were located within the districts, this table do not have a line for the corps.

Table 8: Result of the Beneficiary Survey (100 samples)

Did the Project contributed to reduce damage from yellow sand?	
Contributed a lot.	43 %
Contributed somewhat.	57 %
Did not contribute.	0 %
Did not contributed at all.	0 %

3.4.2. Contribution to Economic and Social Stability

(1) Contribution to Stable Production of Forest Plants

The growth status of the Project's Economic Forests had no problem. The production amount per unit area increased every year. Among the main products, grapes and hop were to be in the stable production period three years after planting. These products attained the targets in production and shipment price ahead of others (Table 9). The price of jujube has been growing steadily, but its production has not stabilized. The production and price of alfalfa have stabilized since 2011. Regarding fruits, it was unclear what species were given targets at the time of the appraisal, and it was not possible to compare targets with actual

[27] Desert is defined as an area with an annual rainfall amount of 250 mm or less; half-desert, an area with an annual rainfall amount between 250 and 500 mm. The area in the table is the sum of desert and half-desert areas.

values.

Table 9: Annual Production and Shipment Price of the main Economic Forests Products

		Target	Actual					
		2010	2008	2009	**2010**	2011	2012	2013
Grapes	Production (t/ha)	**25.0**	19.0	24.8	**33.8**	37.6	38.0	39.0
	Price (yuan/t)	**5,000**	4,582	4,608	**5,737**	6,318	6,898	6,457
Hop	Production (t/ha)	**5.0**	5.3	5.3	**5.7**	5.7	6.3	7.4
	Price (yuan/t)	**6,500**	11,070	5,943	**6,763**	6,466	5,913	7,160
Jujube	Production (t/ha)	**8.0**	4.0	5.0	**8.0**	5.3	7.3	9.0
	Price (yuan/t)	**6,000**	4,500	4,200	**5,100**	6,600	6,300	7,800
fruits[28]	Production (t/ha)	**37.5**	10.7	12.8	**15.1**	18.1	22.1	25.7
	Price (yuan/t)	**3,000**	2,255	2,285	**2,350**	2,565	2,815	3,020
Alfalfa	Production (t/ha)	**30**	24	26	**29**	31	30	30
	Price (yuan/t)	**800**	555	591	**1,065**	1,127	1,204	1,159

Source: Gansu Provincial Government Finance Bureau Agricultural General Development Office

(2) Contribution to Economic Stability

At the time of the appraisal, the target annual income for farmers and farm employees was 3,068.4 yuan. All the Project cities and Gansu Agribusiness Corp attained the goal (Table 10). Compared to the numbers in Table 11, the average income of the project area was higher than the national and provincial averages, i.e., 1.3 times the national average, and 2.2 times the average for farmers in the province. The annual income growth rate between 2004 and 2010 was 194%. Even if the inflation rate of 20.5% in China during the same period is taken into account, the income growth was significant. Thus it is fair to say that the Project contributed to increasing the farmers' income.

Table 10: Average Annual Income in the Project Implemented Cities (unit: yuan/year)

	2004	2005	2006	2007	2008	2009	**2010**	2011	2012	2013
Wuwei City	4,174	4,469	4,744	5,106	5,763	6,410	**6,685**	6,814	6,996	7,198
Jinchang City	3,535	3,751	3,943	4,137	4,515	4,989	**6,195**	7,780	9,133	10,200
Zhangye city	2,535	2,802	3,043	3,302	3,591	3,972	**5,864**	6,674	8,041	8,959
Jiayuguan city	3,823	4,645	4,947	5,268	5,625	6,956	**7,865**	9,304	10,999	12,351
Jiuquan city	4,407	4,750	5,315	5,836	6,452	6,956	**7,180**	8,030	9,450	11,190
Gansu Farms Agribusiness Corps	5,160	6,194	6,956	9,056	10,512	11,824	**12,061**	12,496	12,848	13,521
Average	3,939	4,435	4,825	5,451	6,076	6,851	**7,642**	8,516	9,578	10,570

Source: Gansu Provincial Government Finance Bureau Agricultural General Development Office

Table 11: Average income of farmers in nation and Gansu Province (unit: yuan/year)

	2004	2005	2006	2007	2008	2009	**2010**	2011	2012
Nation	2,936	3,255	3,587	4,140	4,761	5,153	**5,919**	6,977	7,917
Gansu Province	1,852	1,980	2,260	2,645	2,724	2,980	**3,425**	3,909	4,507
Inflation Rate	3.90	1.80	1.50	4.80	5.90	-0.70	3.30	5,40	2.65

Source: National Statistical Yearbook, inflation rates referred to IMF World Economic Outlook Database

(3) Social Impacts from Afforestation

In the original Project plan, small-scale farmers were expected to plant trees and crops in

[28] The data of apple and pares

their own lands and generate ecological and economic effects. However, the main implementation bodies were changed to large-scale farmers, group of farmers, and private entities. The small-scale farmers, who had been scheduled to take part in the Project, benefitted indirectly from the Project by renting their lands or being employed for planting and harvesting and as forest patrol. In addition, consideration was made for low-income areas and minorities when hiring people for afforestation. Thus it is fair to say that the Project made a contribution in social aspects.

3.4.3. Other Impacts

(1) Impacts on the Natural Environment

No negative impacts from the Project on the natural environment have been found. To protect native vegetation, ground leveling was done on a limited scale. This method also minimized the loss of water by evaporation. To enrich forest resources and biodiversity, it was recommended to build mixed forests with multiple tree species. Almost all the Project sites became mixed forests as planned. There were a few mixed forests consisting of groups of simple forests. According to a local forestry expert, they were just as vulnerable to diseases and pests as simple forests. However, Gansu's temperature and humidity are low throughout the year, which is a climate that is unlikely to cause an outbreak of diseases and pests. Thus it is fair to say that the influence of those few mixed forests was limited.

Regarding the diversity of animals and plants, forest patrol people in a Closure area confirmed the habitation of Mongolian gazelles, an endangered species.

The Project used existing water for irrigation instead of digging new wells. Thus problems such as drying up of ground water did not occur. In addition, there was no concern on salt accumulation because the Project applied water-saving irrigation. The periodical monitoring of salt accumulation was not conducted.

(2) Land Acquisition and Resettlement

No land acquisition or resettlement occurred in the Project because afforestation was implemented by the farmers or forestry farms that had forest land tenure, or prepared by renting the tenure. In a few Project sites, local governments built parks with public forests. However, these parks were built in desert areas where no land tenure had existed, and there was no land acquisition or resettlement.

(3) Other Positive and Negative Impacts

The Protection Forests, Closure, Engineering Sand Fixation were for ecological improvement. No economic effects could be expected from them because they incurred costs

for maintenance but would not produce forest products. The sites in four cities[29] have been trying to use those forests as a tourism resource to increase economic and social impacts.

In summary, the Project contributed to desertification prevention because the Project's afforestation and planting areas were equivalent to 63% of the desert reduction area in Gansu Province. In addition to the ecological conservation effects, economic and social impacts also emerged. Therefore the effectiveness and impacts of the Project are high.

3.5. Sustainability (Rating: ③)

3.5.1. Institutional Aspects of Operation and Maintenance

(1) Executing Agency

To implement the Project, the independent Yen Loan project office was established under the Gansu Provincial Government Finance Bureau Agricultural General Development Office. The project office was closed upon the expiration of the loan contract in 2012. Then the Agricultural General Development Office took over the Project's operation and maintenance responsibility including administrative work for repayment, and guidance and supervision to the city and prefectural governments.

The operation and maintenance structure at the city and county level had no major change after the completion of the Project. The city and prefectural financial bureaus managed repayment, and provided guidance and supervision to the implementation bodies. In a few counties, forestry bureaus took the same responsibilities. Table 12 shows the numbers of human resources in the cities where the Project was implemented and the Gansu Farms Agribusiness Corp. At the time of the ex-post evaluation, the executing agency's scope of work and responsibilities were clearly defined, and no problem was found in the institutional aspects of operation and maintenance.

The Project set project offices in the province, city, and county finance bureaus that supplemented expertise by hiring desert and afforestation experts. In a few Project sites visited for the field study, some farmers selected species such as jujube and apple that were unsuitable to the local climate and soil, and a few irrigation facilities and forests were not maintained properly. In such sites, economic returns to afforestation expenses were low. It would be necessary to strengthen local engineers' guidance on selecting species, cultivation methods, and forest operation and management. It would also be desirable to work more closely with the specialized section for training in the forestry bureau.

[29] The four sites are: ①Jiuquan city Jinta county state-owned Jinta lake forestry farm: protection forest to prevent sand flow to the dam lake. ②Jiayuguan city eastern lake: park with protection park surrounding a water source in the central city. ③Jinchang city Jinchuan district Jinshui lake: park with protection forests surrounding an artificial lake. ④Wuwei City Gulang county Malutan foresty farm: model forest displaying fencing closure, Engineering Sand Fixation and desert plants.

Table 12: Number of Human Resources in Project Office (unit: persons)

	Total	Manager	Finance	Engineers	Of Senior level
Plan N/A					
Actual (2014)					
Wuwei City	74	14	7	53	10
Jinchang City	39	11	1	27	0
Zhangye city	173	22	9	142	31
Jiayuguan city	14	4	1	9	0
Jiuquan city	126	13	5	108	3
Gansu Farms Agribusiness Corps	58	18	8	32	5
Total	484	82	31	371	49

Source: Gansu Provincial Government Finance Bureau, Agricultural General Development Office.

(2) Implementation Bodies

Large-scale farmers, groups of farmers, and enterprises operated and maintained Economic Forests. Afforestation sites for the public benefit such as Protection Forests, Closure, and Engineering Sand Fixation were under the responsibility of local governments and state-owned forests including afforestation and erosion control stations.

At the beginning, small-scale farmers were to be the main implementation bodies. However, it would take years until farmers can gain stable income from forests, and it would be difficult for them to cover the maintenance costs of forests until then. Thus the change of implementation bodies was favorable for securing the institutional sustainability in operation and maintenance.

The executing agency and its subordinate organizations defined their coordination, scope of work, and responsibilities clearly. In addition, implementation bodies with financial resources and organizations for the public interest have been operating and managing the Project. Therefore no problem was found in the institutional aspects of operation and maintenance.

3.5.2. Technical Aspects of Operation and Maintenance

The Gansu Provincial Government Finance Bureau Agricultural General Development Office said that county and township project offices have sufficient leadership skills and sufficient technical transfer was executed. At the time of the ex-post evaluation, the provincial project office transferred Yen Loan project management techniques to local governments. Every local government followed the provincial filing method for document management, and was fully equipped with publicity videos, brochures, and project reports. Training on forest and grassland operation management techniques for city, county, township, and forest farms was implemented for 8,105 people, i.e., 174% of the plan, and provided the trainees with necessary knowledge and techniques for the operation and management of forests.

Training for implementation bodies was provided to 34,500 people, or 145% of the plan. According to the results of the beneficiary survey, 78% of the respondents received training more than once while 22% never took the training. About 80% of the respondents attended the

sessions on afforestation techniques, seedling handling, and forest disease and pest control, but not many answered that they took other subjects. To the question on the effects of the training, the respondents answered that effective training subjects were also afforestation techniques, seedling handling, and disease and pest control (Table 13).

Training was provided between 2004 and 2007, which was the timing for planting trees and grasses. The subjects for the training were made suitable for the timing by prioritizing afforestation techniques, seedling handling, and disease and pest control. It is fair to assume that, at the time of the training, there was not much interest in forest maintenance, forest products utilization and sales, which would be needed in the mid- to long term.

In the field study, problems were found in some of the Economic Forest sites where farmers selected that were unsuitable to the climate and soil, and maintenance was not appropriately provided, reducing the productivity. To the farmers with variety selection and maintenance problems, it would be desirable to provide additional training and individual guidance.

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 skills?	
Afforestation Technique	77 %	Afforestation technique improved	82 %
Seedling and plants handling	80 %	Seedling and plants handled appropriately	87 %
Forestry diseases and pests prevention	86 %	Prevented and cured forest diseases and pests	73 %
Fertilizer usage	59 %	Fertilizer used appropriately	45 %
Forest management	36 %	Managed forest appropriately	28 %
Funds management	26 %	Managed funds appropriately	34 %
Products and thinning cut sales	5 %	Sold products and thinning cut appropriately	27 %
water facility management	24 %	Water utilized reasonably.	34 %

Closure and large Protection Forests prepared a patrolling system and manuals, and monitoring station personnel patrol the area. Farmers kept their forests by themselves, but had no manual or maintenance records.

No problem was found in the executing agency's technical aspects of operation maintenance. Among the implementation bodies, some farmers lacked knowledge and appropriate forest maintenance, and needed additional training. The vast majority of the bodies had no problem in technical aspects.

3.5.3. Financial Aspects of Operation and Maintenance

(1) Executing Agency

The provincial forestry budget in 2010 was three times the one in 2004, and secured budget allocations for new afforestation and maintenance. National programs such as the Program of Converting Steep-Farmland Back to Forest, Natural Forest Resource Protection Program, Yangtze River Basin Shelter Forest Programs, and Ecological Forest Program provide subsides as the part of their budgets. For forest maintenance, fire prevention, disease and pest control, departments in the provincial forestry bureau have their own budgets.

Budgets were distributed to the city and county level based on the needs, and the necessary amounts were secured every year. In the Closure area neighboring the Inner Mongolia autonomous region, the regional government's subsidies for grazing reduction and helping nomads settle down reduced damages to forests by livestock in the Project areas.

Table 14: Provincial Forestry Related Annual Spending (unit: ten thousand yuan)

	Total Spending	Forests & Pasture maintenance	Ratio to the total Spending	New Afforestation and Vegetation	Ratio to the total Spending
2010	722,797	43,326	6.0 %	64,285	8.9 %
2011	608,123	13,100	2.2 %	80,692	13.3 %
2012	756,920	77,567	10.2 %	93,647	12.4 %
2013	790,723	52,614	6.7 %	79,513	10.1 %

Source: Gansu Provincial Government Finance Bureau Agricultural General Development Office.

Table 15: Annual Budget for Forestry and the Sources (unit: ten thousand yuan)

Year	Annual Budget	Budget from National	Domestic Loans	Bonds	Foreign Investment	Self -financing	Other Funds
2004	206,800	38,576	160,752	676	180	236	298
2005	253,385	34,332	200,486	12,398	87	1,751	4
2006	233,372	17,496	208,315	6,906	612	0	43
2007	254,377	22,295	218,892	10,850	2,340	0	0
2008	367,149	36,319	304,688	10,198	1,239	0	6,985
2009	482,817	29,681	316,741	13,000	2,733	693	112,724
2010	715,630	34,870	472,783	34,600	6,779	5,187	122,632
2011	610,611	487,233	53,000	0	16,000	8,432	40,577
2012	756,920	596,809	93,695	0	16,572	31,349	16,255

Source: National Statistical Yearbook

(2) Implementation Bodies

Large-scale farmers, groups of farmers, and enterprises shouldered the operation and maintenance costs of the Economic Forests. For less profitable forests such as Protection Forests and Closure, state-owned farms and local governments covered the maintenance costs.

According to the beneficiary survey (sample size: 100), the average annual income was 46,641 yuan, which exceeded the average maintenance cost of 43,927 yuan by 2,714 yuan. In the comparison of the income and the maintenance cost (Table 16), 80% answered that their "income is more than the maintenance cost," 11% said that maintenance cost was larger than the income, and 5% said that the income and the maintenance cost were about the same. The reason was that Economic Forests of such plants as jujube and apricots did not reach the tree age for stable production, and those who built only Protection Forests had no income from the forests.

Table 16: Result of Beneficiary Survey on Income and Maintenance Costs

Are you earning or spending more for the Project's forest?	
Income is more than maintenance cost.	80 %
Income and maintenance cost are about the same.	5 %
Maintenance cost is more than income.	11%
Not answered.	4 %

The implementation bodies' repayment to the loan from the county government started in March 2013 at the frequency of once a year. Based on this frequency, the repayment for the first year had been completed by the time of the ex-post evaluation.

The beneficiary survey revealed that the average loan amount was 453,496 yuan (about 8.6 million yen) (Table 17). Regarding the repayment situation (Table 18) at the time of the ex-post evaluation, 20% of the respondents said that their "repayment is going on as scheduled," 26% said that they "have not paid back," 2% said that they paid back with some delay, and another 2% said that they had yet to pay back. The reasons that they failed to repay the loan include "income from Economic Forests is still unstable," "I planted jujube but the profit is too low to pay back the loan." Some answered that they "would like an exemption from repayment and interests."

To the questionnaire survey to the forest farm managers (33 replies), 60% answered that their employees' "repayment is going on as scheduled." For the other 40%, the employees' repayment was stopped or delayed because of insufficiency of income from Ecological Forests and Economic Forests.

In Gansu Province with severe natural conditions, the forests were expected to bring ecological conservation effects. The implementation bodies had the primary responsibility for operation and maintenance, but the county (city, district) forestry bureau would keep paying back the loan for the implementation bodies with the bureau's own sufficient funds until the forests provided sufficient income for the implementation bodies. Therefore no problem was found with repayment.

Table 17: Result of the beneficiary Survey on Repayment Status (100 samples)

Total Loaned Amount	Rate	Starting date for Repayment	Amount Repaid
453,496yuan	0.75%	March 2013	Not answered

Table 18: Result of the beneficiary Survey on Repayment Situation (100 samples)

How is the situation of repayment?	
Repayment is going on as scheduled.	20 %
Repayment is going on with some delay	2 %
Repayment is disrupted.	2 %
Do not pay back	26 %
Not answered	50 %

(3) Operation and Maintenance Cost for Irrigation Facilities

Irrigation facilities were owned by farms, enterprises, and farmers; this means that they had maintenance responsibility. However, according to the beneficiary survey (100 samples), none of the respondents were charged for using the facilities, and only 21% answered that "a maintenance fee was collected." In most of the sites, the local governments covered the operation and maintenance cost.

According to the interviews with province, city, and county governments, in most of the

Project sites with irrigation facilities, the maintenance costs were chronically deficient, and subsidies from provincial government would be essential for current and future operation and maintenance. The Gansu Province Water Resources Bureau obtained a budget of 92 million yuan (2014 performance) for the maintenance and repair irrigation facilities. Thus it is fair to say that sustainability is expected.

Including subsidies from national programs, the provincial forestry budget increased year by year, and the costs for operation and maintenance were secured. The implementation bodies gradually gained stable income as the Economic Forests grew, and financial sustainability would be secured in three to five years. Under normal circumstances, it would be desirable for individual owners or agencies of the irrigation facilities to bear the operation and maintenance costs; however, it is fair to say that, with the government subsides, sustainability of the irrigation system is secured. In summary, no major problem was found in the financial aspects of operation and maintenance.

3.5.4. Current Status of Operation and Maintenance

(1) Operation and Maintenance of Forests

The provincial government considered that the status of forests and grassland and the maintenance situation were good and found no problem. In the five counties and one Gansu Farms Agribusiness Corp where the evaluation team visited for the field study, all the sites including Economic Forests, Protection Forests, Closure, and Engineering Sand Fixation were generally in good condition and maintained appropriately. A few maintenance problems were observed such as that unsuitable species for the area were selected in Economic Forests, necessary nursing and pruning were not done in some farmers' sites, and irrigation facilities were not maintained appropriately.

According to the beneficiary survey, with regard to the forest condition (Table 19), 86% of the respondents said that the condition of their forests was "fine," while 14% considered that "there are a few problems." The causes of the problems were "insufficient water supply" (54%), "damaged by yellow sand" (42%), "damaged by diseases and pests" (39%), "low survival and preservation rates" (39%), and "low yield of products" (31%).

About the forest maintenance, 74% thought that it was "fine," and 26% said "there are a few problems." The problems included "insufficient maintenance budget" (56%), "unable to secure water" (24%), "insufficient manpower" (23%), and "periodical maintenance was not provided" (17%).

Table 19: Result of Beneficiaries Survey on Forest Maintenance (100 samples)

How is the condition of the Forest?		How is the status of forest maintenance?	
Fine	86 %	Fine	94 %
There are a few problems.	14 %	There are a few problems.	2 %
There are many problems.	0 %	There are many problems.	0 %
Not answered.	0 %	Not answered.	4 %

(2) Operation and Maintenance of Irrigation Facilities

The provincial project office believed that the condition of irrigation facilities and maintenance situations had no problem. According to the beneficiary survey (100 responses), 88% of the respondents answered that the condition of their irrigation facilities was "fine," but 9% thought that there were a few or many problems. The problems were explained as "damage and leak of water of the irrigation facilities" (56%), and "deterioration of facilities". The facilities with problems were not the ones built by the Project, but those that the implementation bodies built themselves. However, the field study revealed that some of the Project's irrigation facilities were broken or clogged by trash and needed repaired or better maintenance. Irrigation facilities were used by 99% of the respondents, and 61% answered that water supply was "sufficient" while 33% said that it was "insufficient." The main reason for the insufficiency in water supply was the climate-related causes in desert areas. All the Project sites that answered that water supply was insufficient were either those of shrubbery or fruits that require a large amount of water.

Table 20: Result of Beneficiaries Survey on Irrigation Facilities (100 samples)

How is the condition of the irrigation facilities?		How is the amount of water supplied by the irrigation facilities?	
Fine	88 %	Water supply amount is sufficient	61 %
There are a few problems.	7 %	Water supply amount is insufficient	33 %
There are many problems.	2 %	Not answered	6 %
Not answered.	3 %		

(3) Operation and Maintenance of Facilities and Equipment

① Vehicles (99 units), Motorcycles (12 units), trucks (35 units) were operated and maintained by the allocated organizations, and no problems in use were reported at the time of the ex-post evaluation.

② According to the provincial government, environmental monitoring devices (322 units) were distributed to state-owned forestry farms, erosion control stations, and Gansu Farms Agribusiness Corp and used without any problem. The interviews in the field study did not elicit any clear answer to the questions on what organization had which device, who was responsible for maintaining the device, and how the devices were used.

③ Farm machinery (949 sets) was registered as the property of farms, forestry farms, and Gansu Farms Agribusiness Corp, and each organization took the responsibility for maintenance.

The evaluation team confirmed that the machines were maintained well and kept in a garage. At the time of the ex-post evaluation, some of the tractors and grass reaping machines in heavy use were scrapped because they had broken down.

The maintenance status and condition of forests and grasslands built by the Project were generally good although a few irrigation facilities needed better maintenance. Allocated facilities and devices such as vehicles and farm machinery were used

according to the original purposes.

As mentioned above, no major problems were found in institutional, technical, financial aspects. Therefore the sustainability of the Project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1. Conclusion

The Gansu Afforestation and Vegetation Cover Project aims to improve the forest and vegetation coverage ratios by afforestation and crop planting for preventing desertification, and contribute to social and economic stability. The Project was prompted by the increased importance of afforestation because of the escalation of desertification in China. The relevance of the Project is high because the Project is consistent with the Chinese government's policies, development needs, and Japan's aid policy. For further contribution to desertification prevention in areas with the severe natural environment, the main Project implementation bodies for Economic Forests changed from small-scale farmers to groups of farmers or enterprises, and those for Protection Forests and Closure changed to local governments or state-owned forest farms that act for the public interest. The change was sound for implementing afforestation and crop planting in a more effective area on a larger scale and sustaining the operation and maintenance system while also benefitting the small-scale farmers. The Project's afforestation and vegetation area, equivalent to 63% of the desert decreased in the same period in the entire Gansu Province, contributed to desertification prevention. At the time of the ex-post evaluation, trees and grasses were growing well, and the Project helped increase the production of forest products and income, and improve the living environment. Thus the effectiveness and impacts of the Project are high. With regard to the efficiency, the project period was within the planned limit, although the project cost exceeded the plan because of the additional afforestation and vegetation area. Thus the efficiency of the Project is fair. The exclusive project office for the yen-loan project was dissolved, but no problem was seen in the institutional aspects of sustainability because the Gansu Provincial Government Finance Bureau Agricultural General Development Office, an upper-tier office, took over the office's functions. The budget for operation and maintenance was secured by a subsidy from the national government, and the budgets of the finance and forestry bureaus and the local government. Some farmers needed improvement because of insufficient technical transfer and lack of forest and irrigation facility maintenance. However, both the technical aspects and the operation and maintenance status in most of the forests and grasslands were generally favorable. Therefore the sustainability of the Project is high.

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

4.2. Recommendations

4.2.1. Recommendations to the Executing Agency

(1) In many project sites, the local government covered the irrigation facility maintenance costs. Implementation bodies such as forest farms, farmers, and enterprises would be responsible for the costs and implementation of maintenance and repair under normal circumstances. However, shortage of the maintenance budget caused delays in repair. From now on, to prepare for the decrease in the government's support and address a constant budget shortfall, it is necessary to set a system in which the implementation bodies secure budget by themselves. The facilities built at the beginning of the Project were more than 10 years old at the time of the ex-post evaluation, and were approaching the service life of 15 to 20 years. The executing agency must encourage the implementation bodies to launch an irrigation facility maintenance administration, and establish a system to collect fees or share maintenance cost burdens.

(2) The Project provided training for 34,500 people of implementation bodies, which was more than the planned. However, the beneficiary survey revealed that 78 out of 100 respondents received training, meaning that the Project did not cover all the implementation bodies. The evaluation team found in some Economic Forests, farmers had problems in selecting proper species and maintaining forests. The farmers did not select trees and maintain forests based on scientific knowledge, but kept switching species on a trial-and-error basis. It is desirable that prefectural engineers provide additional training or individual technical guidance for such farmers at the earliest possible stage.

4.2.2. Recommendations to JICA

None.

4.3. Lessons Learned

(1) To raise the ecological effects of an afforestation project, it is important that the executing agency provide consistent guidance and supervision throughout all the steps from the selection of implementation bodies, forest type and species, and to technical transfer.

At the time of the appraisal, the main implementation bodies for the Project were supposed to be small-scale farmers. However, in Gansu Province's severe natural environment, to contribute more for desertification prevention, Sand Protection Forests and Closure were implemented by local governments and state-owned farms. With the sand control experts' opinions taken into consideration, the Project target areas were selected so that they would be where the entire community would benefit such as the entrance of wind from the desert and the areas around water sources, and major desertification prevention measures were implemented. Economic Forests were implemented by large-scale farmers, groups of farmers, and enterprises. They appropriately executed sand protection at leveling, planting, provision of water through

irrigation, and selection of species. As a result, the implementation bodies succeeded in keeping the forests with high survival and preservation rates under the severe environmental conditions. The Project gained the desired ecological conservation effects and enriched ecological system by diversifying tree species because the executing agency dispatched an expert team that not only monitored the indicators but also provided guidance and supervision in selecting forest types and species and maintaining forests. By contrast, because of the lack of guidance and monitoring, in some of the Project sites farmers selected the wrong species, and failed to maintain forests and irrigation facilities appropriately. It would have been desirable to work with the section specialized in technology dissemination in the forest bureau to cover local farmers. Thus, to raise the effects of an afforestation project, the executing agency needs to work with research institutions, engineers, and the technology dissemination section at the local level. It is also important for the executing agency to provide guidance and supervision throughout the process in all the steps from the selection of implementation bodies, forest type and species, and to technical transfer.

(2) By promoting Ecological Forests for tourism, it is possible to envision social and economic effects.

Four Ecological Forests of the Project were built by local governments with the vision to use them for tourism. The main effects of the afforestation were to prevent soil flow into lakes and dams, and improve the residents' living environment by converting deserts in the city area into forests. In addition to Closure and Engineering Sand Fixation, the cities built facilities such as leisure facilities, a meteorological tower, roads, walking paths, fish culture facilities, and electric power plants, and used the Ecological Forests to display the desertification prevention measures, desert-oriented industries, and plants in the desert. If, at the time of project planning, an executing agency considers new ways to use Ecological Forests for purposes such as tourism, it can expect not only ecological conservation effects but also social and economic ones.

END.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
Afforestation		
Afforestation	**91,072 ha**	**136,472 ha**
Protection Forests	16,204 ha	23,825 ha
Arbores	3,471 ha	7,900 ha
Shrubbery	12,734 ha	15,975 ha
Economic Forests	18,264 ha	20,758 ha
Grape	5,042 ha	4,847 ha
Jujube	1,658 ha	1,821 ha
Hop	770 ha	2,626 ha
Fruits mixed	810 ha	1,300 ha
Alfalfa	9,988 ha	10,164 ha
Sand Enclosure Afforestation	51,106 ha	86,284 ha
Engineering Sand Fixation	5,493 ha	5,604 ha
Afforestation Material		
Seedling	190.5 million	247.65 million
Chemical Fertilizer	12,993 ton	19,739 ton
Organic Fertilizer	113,942 ton	147,367 ton
Pesticide	682 ton	863 ton
Facilities and Equipment		
Canal	1,110 km	1,202 km
Irrigation	8,978 ha	9,317 ha
Impoundment	780 m^3	4,780 m^3
Road construction	845 km	1,134 km
Electric Line	20.8 km	As planned
Transformer	8 sets	As planned
Construction	13,280 m^2	13,560 ㎡
Farm Machinery	894 sets	949 sets
Vehicle	125	99
Motorcycle	217	12
Truck	35	As planned
Environment Monitoring Tools	350 pieces	322 pieces
Training		
Training		
City Government	30 persons	As planned
County /Township Government	3,610 persons	6,710 persons
Gansu Farms Agribusiness Corp	1,030 persons	1,365 persons
Technical Guidance(participants)	23,800 persons	34,500 persons
2. Project Period	March 2003 -October 2010 (92 months)	March 2003-October 2009 (80 months)
3. Project Cost	208 million yen	12,388 million yen
Foreign currency	16,392 million yen	4,534 million yen
Domestic currency	(826 million yuan)	(319.4 million yuan)
Total	16,600 million yen	16,933 million yen
Yen loan	12,400 million yen	12,388 million yen
Exchange rate	1 yuan=15yen (September 2002)	1 yuan=14.19588yen (average rate 2004-2009)

Attachment: Growth Situation in the Project Sites

1. Economic Forests

(Jujube, Apple, Pears, Grapes, Alfalfa)

The preservation rates in all the sites were 85% or higher. No disease or pest damage was observed, and trees grew generally well. The team was unable to measure the growth of the vines. As the alternative the team interviewed engineers to confirm the growing status. Alfalfa had been cropped. However, by calculating the remaining stumps, the team confirmed that the coverage ratio was nearly 90%. Regarding the maintenance status, weeding, fertilization, disease and pest control, and irrigation system maintenance were appropriately executed. A few farmers cultivating jujube and pears had problems in implementing such maintenance tasks, and needed guidance. Other farmers selected varieties that were unsuitable for dry and cold areas such as apple and jujube. It would be desirable for Forestry bureau engineers to provide advice to the farmers on nursing and variety selection.

Variety	Tree Age (year)	Height (m)	Tree Crown (m)	Base Circumference (cm)	Density (#of tree/mu)	Preservation Rate (%)
Jujube	8	1.5	2.9	1.4	296	85
	11	3.5	1.4	5.1	45	85
	17	3.4	2.2	7.0	45	85
	Average	2.8	2.2	4.5	---	85
Apple	8	3.4	2.9	12.8	45	95
Pears	8	5.3	1.9	10.3	56	85
	11	3.0	1.8	7.0	133	90
	Average	4.2	1.9	8.7	---	87.5
Grapes	8	---	---	---	185	---
	10	---	---	---	167	---
Alfarfa	10	---	---	---	(Coverage rate) 90	

2. Protection Forests

2-1 Arbores (Poplar, Locust, Japanese Pagoda Tree, Euphrates Poplar, Willow, Spruce, Scots Pines, Russian Olive)

The preservation rate was over 75% in all the species. Arbores were planted as a windbreaker in roadsides, farm fields and the banks of waterways. The trees were mostly growing well, and appropriate disease and pest control measures were taken. In a park (Jiayuguan City), Willow, Spruce, Scots Pines were planted in favorable environment where pipe irrigation fully equipped and provided irrigation water 25 times in a year. Almost all the sites were mixed forests. Mixed forests in parks were formulated by putting together simple forests of multiple species because the parks were meant to display the trees.

Variety	Tree Age (year)	Height (m)	Circum-ference (cm)	Density (#of tree/mu)	Preservation Rate (%)	note	
Poplar	11	14.1	10.1	667	80		
	10	18.3	13.4	197	90		
	Average	16.2	11.75	---	85		
Locust	10	8.4	9.75	154	83		
Japanese Pagoda Tree	6	3.3	6.4	42	80		
	10	10.2	12.4	111	80		
	Average	6.75	9.4	---	80		
Euphrates Poplar	10	6.4	8.3	16	85		
Willow	10	10.9	12	167	80	cut to 2.5m	park
Spruce	9	2	4.4	167	90		
Scots Pines	9	5.6	8.9	167	90		
Russian Olive	10	2.3	10.1	333	75		

2-2 Shrubbery (Chinese Tamarisk, Saxaul, *Caragana intermedia, Hedysarum scoparium*)

The shrubbery sites were effective in wind breaking. Local species that are suitable for desert were selected and planted. All the sites were mixed forests with multiple species. The preservation rate was higher than 73%, and the growth condition was generally good. Regarding the maintenance, pruning work needed at a few Hedysarum scoparium sites. The coverage ratio of shrubbery reached more than 30% in all the sites. Thus it is fair to say that sand flow prevention effects were generated.

Variety	Tree Age (year)	Height (m)	Tree Crown (m)	# of branches	Density (#of tree/mu)	Preservation Rate (%)
Chinese Tamarisk	10	2.5	2.4	11.8	121.5	85
Saxaul	10	2.2	2.1	9.3	296	80
Caragana intermidia	10	2.0	1.6	11.8	146.3	73.3
	11	2.2	1.9	10.8	167	75
Hedysarum scoparium	10	1.8	2.2	10.2	80.0	77.5

3. Closure

(*Nitraria roborouskii,* Saxaul, Chinese Tamarisk, *Kalidium gracile*, *Reaumuria soongorica*)

The vegetation coverage ratios were 47% in Jinchang City Jinchuan district and 40% in Jiayuguan City. Ten years after the beginning of the closure, multiple species of shrubbery and grasses grew well, and sand flow prevention effects were generated as a result of the vegetation recovery. In one site that was closed for 11 years, the vegetation coverage ratio was 20%, which was below the target. However, this was not a problem because irrigation facilities and wind protection forests were built near the sites to convert them into Economic Forests of apple trees. In some sites, Nitraria roborouskiis were planted, and were given nutritional supplement

because their roots could be sold as herbal medicine.

Variety	Tree Age (year)	Vegetation coverage (%)	Location
Nitraria roborouskii, Saxaul, Kalidium gracile	10	47	Jinchang City Jinchuan district
Nitraria roborouskii , Reaumuria soongorica	10	40	Jiayuguan City

END.