China

Ex-Post Evaluation of Japanese ODA Loan Project

The Afforestation Project for Conservation of Middle Stream of Huanghe in the People's Republic of China (Phase II)

External Evaluator: Yuko Kishino, IC Net Limited

0. Summary

As part of the China's national afforestation plan that has as its aim increasing forest cover rate, this project was implemented as a tree planting model for the creation of shelter belts on the Loess Plateau with its desolate denuded land and unfavorable site location. Carefully considering local conditions, a basic design was drafted, and based on this work it was rigorously implemented, and this led to high survival rates[1]. Incorporating farmers from the planning phase and using the soft component and ensuring training of dissemination officials and farmers also contributed synergistically to the success of the project. The afforested area created successfully in this project was highly evaluated, which led to the raising of Shanxi unit planting value[2] and other improvements in policy as well as to the progress in afforestation over the entire area. Hereinafter in order to be maintained as a highly successful afforested area and to be used as a model for afforestation in the Loess Plateau entire region, it will be important to ensure appropriate forest nurturing and protection based on the state of tree growth.

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

1. Project Description

Project Locations

Daning (left) & Jixian (right) afforestation area

[1] Indicator representing the results (success) of afforestation efforts. Survival rate = no. of seedlings/number planted x 100

[2] The unit cost for planting 1 mu* , including costs related to capital wages and salaries, procurement of nursery stock, shipping, water supply, etc. *1 mu =0.0667 hectares

1.1 Background

Excess land clearing for food production and tree-clearing for timber production resulted in the reduction of forested areas to 13.9% of the Chinese national land area[3]. The water-retention function of forests had been lost and sediment runoff had increased. The Huanghe[4] and Yangtze basin areas had particularly high rates. In the Loess Plateau that extends through the Huanghe area, where easy to erode fine yellow sand grains piled high, heavy runoff occurred in the rainy season. At the time of the project planning, sediment production went from 5,700 tons/year to 9,400 tons/year per km^2 [5] and problems such as drought, flooding and reduced land productivity were apparent.

The Chinese government designated the forests of the Huanghe as the focus area for land and water maintenance and growth protection measures as well as measures to prevent landslides. Japan cooperated with China through Japan International Cooperation Agency (JICA)'s technical cooperation in terms of the "Loess Plateau afforestation training program project" (1990 to 1995) was and the "After-care cooperative program" (1999 to 2001) with a view to developing sediment runoff prevention techniques. The 1998 Yellow River flood disaster also gave impetus to Japan-China cooperation in terms of forest conservation and nurturing.

Amid such circumstances, the Chinese government requested from the Japanese government grant aid for efforts to improve the forest coverage rate in the Shanxi Xinshuihe basin area[6] (Midstream Huanghe).

1.2 Project Outline

The objective of this project is creating a model for dissemination of planting techniques and training of Shanxi Forestry department dissemination staff, thereby improving Shanxi Xinshuihe basin area (Jixian, Daning, Puxian and Xixian) forest coverage rate.

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[3] China's State Forestry Agency: The 4th forestry resources survey. (1989-1993)

[4] The source of the Huanghe is in Qinhai province and it flows into the Bohai bay and its total length is 5,464 km. The Huanghe river basin comprises Shanxi, Shaanxi, Henan, Gansu provinces and Ningxia, Neimenggu, with a total area of 750,000 km^2

[5] Shanxi Province Forestry Agency Shanxi Province Loess Plateau Xinshuihe Construction forest project (2001) p.2 It is said the Japanese yearly mountain area soil production volume per 1 km^2 is 250 tons. JICA's China Huanghe Loess Plateau conservation techniques training plan preliminary report (1988) p. 7

[6] Huanghe tributary is located at the southern end of Shanxi and Shaanxi; and this area strides Jixian, Daning, Puxian, and Xixian counties. It is said to be the area with the highest sediment runoff.

Grant Limit/ Actual Grant Amount	1,712 million yen (179 million yen, 519 million yen, 427 million yen, 369 million yen, 218 million yen)/ 1,649 million yen (176 million yen, 495 million yen, 412 million yen, 348 million yen, 218 million yen)
Exchange of Notes Date/ (Grant Agreement Signing Date)	1st term: March 2003, 2nd term: August 2003, 3rd term: July 2004, 4th term: June 2005, 5th term: June 2006
Implementing Agency	Shanxi Forestry Department
Project Completion Date	November 2007
Main Contractor	Techno Forest Co., Ltd./Oji Forest an Products Co., Ltd. Joint-venture 1st term); Ogawa Seiki Co., Ltd./ Fujigisou/ Taiki Co., Ltd. joint-venture (2nd term); Huanghe Afforestation joint-venture (Oji Forest and Products/Techno Forest Co. Ltd.) (3rd term); Ogawa Seiki Co., Ltd./OISCA joint-venture (4th and 5th terms)
Main Consultants	Japan Overseas Forestry Consultants/ Japan Forestry Engineering Consultants joint-venture
Basic Design	October/2001 - March 2002; May 2002 - January 2003
Related Projects	"The Loess Plateau Afforestation Techniques Training Project" "The Loess Plateau Afforestation Techniques Training Project Aftercare" "The Promotion of the Dissemination of New Technology for the Loess Plateau Forest in China Project" (All the three above: technical cooperation projects) "Loess Plateau Afforestation techniques promotion/dissemination project" (In-country training)

	"Shanxi afforestation project" (Yen loan) "Project for Afforestation for Conservation of Up and Middle Streams of Huang He in the Nignxia Hui Autonomous Region (Huanghe Middle Stream Shelter Belt Creation Plan)" (Grant aid) Others[7]

2. Outline of the Evaluation Study

2.1 External Evaluator

Yuko Kishino, IC Net Limited

2.2 Duration of Evaluation Study

The evaluation for this project is as follows:

Duration of the Study: November 2010 to October 2011

Duration of the Field Study: April 13, 2011 to April 30, 2011, June 6, 2011 to June 8, 2011

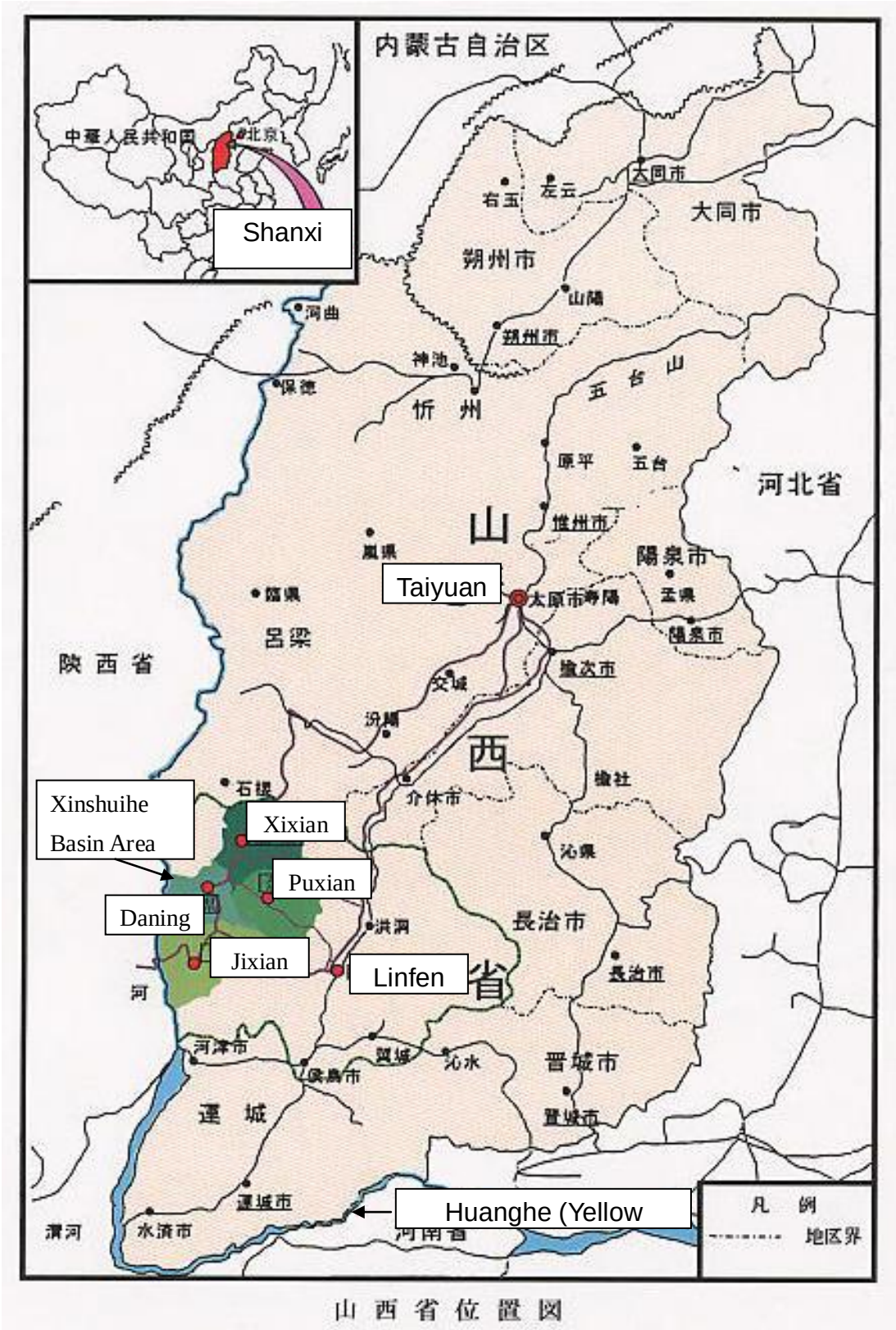
2.3 Constraints during the Evaluation Study

None

Fig. 1 Huanghe river, main stem (Jixian)

Fig. 2 Model stand based on JICA technical cooperation

[7] "Forest resources development protection plan", "poverty area forestry development plan" (these two with World Bank), "Northern Shanxi Construction Forest project" (with German KfW Bankengruppe)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運城市
渭河
水済市
Huanghe (Yellow
河南省
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地区界

山西省位置図

Figure 3 Project Implementation Site

3. Results of the Evaluation (Overall Rating: A[8])

3.1 Relevance (Rating: ③[9])

3.1.1 Relevance with the Development Plan of China

(1) Development policies at the planning stage.

In 1998, as part of the "National Ecological Environment Establishment Plan 1998-2050", the Chinese government designated the Huanghe river basin area as a critical area for sediment runoff, and promoted projects for the protection and nurturing of stands to improve forest cover. In Shanxi, this was a starting point, and the "Shanxi ecological environment plan" was implemented and a target of forest cover increase from 11.7% in 1998 to 45% in 2050 was set. To realize this goal, three of the six priority large-scale forestry projects,[10] namely the "Natural forest conservation"[11], "Three North Area and Yangtze river basin area forest reserve system construction"[12], and "Conversion of cultivation land to forest cover land"[13], were implemented, and international funds such as World Bank and German KfW Bankengruppen funds were proactively used to this end.

(2) Development policies at ex-post evaluation

In Shanxi province, the 11th 5-year plan (2006-2010) set out the "Green Shanxi" motto, and six large-scale projects such as roadside greening and afforestation of desolate mountain areas were implemented. The 12th 5-year plan (2011-2015) called for continuing afforestation efforts, and set targets of 3.77 million hectares by 2015, and 4.33 million hectares by 2020. In 2010, "Shanxi forestry development plan" replaced the "Shanxi ecological environment construction plan" and was implemented, and the targets of 23% forest coverage by 2015, and 26% by 2020 were set.

This project, like the afforestation plans with aims of forest cover rate improvements such as that mentioned above, was carried out as a model for conservation forest[14] along the Loess Plateau Xinshuihe area (with its severe environmental conditions), and relevance was designated as "high" at both the planning and ex post-facto evaluation stages.

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

[9] ③:High,②:Fair, ①:Low

[10] "Natural forest conservation", "Three North area and Yangtze river basin area reserve forest system construction", "Conversion of cultivation land to forest cover land", "Peking/Tianjin wind-blown sand control", "Wildlife protection and nature conservation area construction", "Priority area fast-growing high-yield timber production base construction".

[11] Regulate clipping of trees in natural forest for conservation purposes.

[12] Conservation forests constructed in Northeast, Huabei, and Xibei areas

[13] Stop farming inclined land areas and plant trees instead.

[14] Planting for this project in the target area was in land characterized by unfavorable afforestation conditions of thick Loess soil on inclined land, while the yen loan project "Shanxi afforestation project" (2001～2005) was directed to lands with relatively favorable afforestation conditions, though natural environment had deteriorated.

3.1.2 Relevance with the Development Needs of China

3.1.2.1 Relevance with needs

The Loess Plateau is a mountainous area characterized by high soil runoff and croplands and forested areas received significant damage due to erosion. The Xinshuihe area is characterized by the typical Loess plateau landform, and so soil runoff was at its worst here.

As mentioned before, after 1990, cooperation on afforestation techniques research and verification of planting techniques as well as the setting of afforestation standards took place. However, general planting operations did not achieve stand establishment in most cases due to lack of a plan or inadequate compliance. As the planting activities proceeded in the Loess Plateau, operation on land that is in good condition decreased, and planting in bad weather and denuded land conditions became necessary.[15]

In conditions such as those described above, there was a need for cooperation in terms of grant aid, and introduction of Japanese supervision of works methods in order to promote the success of planting initiatives and for such a model to be effectively disseminated.

3.1.2.2 Relevance of the plan

This project's aims are to promote farmers' afforestation activities, and a soft component of a scale and with content that are comparable to those of a technical cooperation was implemented. According to the soft component guideline (April 2004), involvement of Japanese consultants must be kept to a minimum in principle, to ensure the smooth start-up of the counterpart country's project and at least the minimal level of sustainability of cooperation effects. Even though there was a considerably greater involvement of Japanese consultants in this project than generally envisaged in the Guideline, it is commendable that that the project was planned, with out-of-the-box thinking, as an afforestation project integrated with technical support and achieved the intended synergistic effects.

One of the background factors is that the government started encouraging farmers and other individuals to engage in planting initiatives in 1998. As the government forestry sector had been directly involved in afforestation work up until then, the government had only limited experience of disseminating highly effective planting techniques to outside. There was however crucial need to disseminate planting techniques among farmers. To respond to this need, 1) dissemination agents were trained 2) farmers were trained, 3) tree planting

[15] The area of denuded land exceeded 7.33 million hectares, accounting for about 20% of the total area.

apprenticeships established[16], 4) exhibitions of planting techniques were held, and 5) organizing of awareness seminars were all incorporated in the project plan. The result of the training program implementation is that planting programs developed in the correct order and this led to high survival rates. In addition, the result of farmers experiencing planting first hand was that they acquired planting techniques first hand, as well as the incentive to do so, and it can be said that this project has succeeded in serving as a model to encourage afforestation activities by farmers.

3.1.3 Relevance with Japan's ODA Policy

In the "Economic Cooperation Program for China" (formulated in 2011) that represents a Country Assistance Program for China, "cooperation towards resolving environmental and other global issues" is listed as the number one priority area for economic cooperation, and the importance of afforestation and forest conservation, including the issue of the adverse effects on Japan of airborne sand particles, and cooperation on these areas are emphasized.

Afforestation activities from the year 2000 such as soil runoff prevention forest reserves construction were implemented in terms of funds of the Japan-China Greening Exchange Fund[17]. A total of 57.32 million yen has already been invested in Shanxi, and three projects are presently in the implementation phase[18]. Completion of the afforestation of 476 ha is foreseen for the year 2013.

As described above, this project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy and afforestation activities; therefore its relevance is high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

The outputs of this project have been realized mostly according to plan. Japanese output planning and results are outlined in Table 1. Because drawings were carefully made at the time of survey for basic design, there were no major changes at the detailed design stage, and each area showed only marginal increases or decreases in planting land area[19]. The change that was

[16] At the planning stage Japan side intended this apprenticeship program to be, in some sense, a way to reduce the project cost, but in actual fact, it contributed to enhance project effect.

[17] This Fund was set out when now deceased Prime Minister Obuchi visited China in 1999. Triggered by the 1998 great floods, the Fund grants aid to project for shelter forest creation and afforestation for, wildlife protection and desertification prevention.

[18] (i) The "Wutaishan greening project" designed to protect world heritage sites, (ii) "PRC Loess Plateau vegetation restoration Shanxi model forest construction project", (iii) "PRC Loess Plateau Shanxi desertification and land/water preparation model project" for dam conservation

[19] In Xi County, the planting land area is smaller than planned, because as a result of the torrential rains in the third year, shrubs grew in the originally treeless land and the need for planting disappeared. In exchange, the planted land area in Jixian was increased in view of the conditions there.

significant was for the "management simplification technical demonstration stand"[20], one of the programs in the "soft component". Surface area was decreased from 5 ha to 1.1 ha, and in the 4th term of the project, it was discontinued completely. This was a good decision because of the difficulty of seed germination due to dryness caused by low precipitation and due to weeds thriving due to simplified operations, which rendered growth difficult. As for Chinese outputs, construction and maintenance of access roads and conservation staff stations, training of such staff, dissemination activities, and nurturing after the effective term were all implemented effectively.

Fig. 4 Thuja orientalis Planted in 2006 (Jixian)

Fig. 5 Mixed stand of Robinia pseudoacacia and Thuja orientalis (Daning)

Fig. 6 Forest road (Daning)

Fig. 7 Peach showcase grove (Jixian)

[20] Simple greening through direct-seeding method tried in the 2/5 term

Table 1 Japanese outputs

Item	Details	Plan	Actual results
Construction of model afforestation	Planting surface area total	4,828.6 ha	4,827.8 ha
	(1) Jixian Tunli	1,104.3ha	1,196 ha no. planted 1.5 million
	(2) Puxian Jiejiahe	1,238.2ha	1,210.6 ha no. planted 1.5 million
	(3) Xixian Huangtu	1,344.2ha	1,196 ha no. planted 1.43 million
	(4) Daning Sandu	1,141.9ha	1,196 ha no. planted 1.57 million
Facilities construction	1) Civil construction		
	(1) woodland path new construction	79.5km	78.8km
	(2) small check dams	21 spots	21 spots
	(3) weather/soil measurement station/ observat	1 spot	1 spot
	2) Building construction		
	(1) lookout tower	8	8
	(2) conservation staff station	4	4
	(3) project introduction board	8	8
Equipment procurement	1)Maintenance management equipment	1 system	1 system (no change)
	2)Equipment for outreach	1 system	1 system (no change)
Soft component	1)training of outreach officials in the forestry department	2,420 people	2,501 people
	2)training of Daningxian agricultural workers	900 people	1,050 people
	3)Training students	400 people	567 people
	4)Practical training of Daningxian farmers in planting	900 people	900 people
	5)Exhibition of various tree varieties/products or techniques		
	Showcase forest (4 provinces, 4 areas)	28ha	28.2ha
	management simplification technical demonstration stand (Daningxian)	5ha	1.1ha
	6) Educational seminar	4 times	4 times

3.2.2 Project Inputs

3.2.2.1 Project Cost

This E/N budget limit of this project was 1,712 million yen, the Chinese contribution was 73 million yen and the total project cost was 1,785 million yen. The actual costs were 1,718 million yen, with the Japanese share being 1,649 million yen, and the Chinese share being 69 million yen, so the project was done within budget for both sides. Because it was divided into 5 terms, procurement of materials was carried out with attention to exchange rate movements and this was a big factor in staying within the budget. However, decreases in efficiency were seen as the construction consultants responsibilities increased with the revision of contracts related to execution deadline extensions etc., as term bidding fees accumulated each term, as construction workers turnover was high, and as nurturing, planting, support planting, land leveling operations for a particular stand proved ineffective.

Table 2 Project planned costs and actual costs

	Planned	Actual	Difference with plannned
Total amount	1,785 million yen	1,718 million	96%
Japanese portion	1,712 million yen	1,649 million	96%
Of which, soft component	325 million yen	293 million yen	90%
Chinese portion	73 million yen	69 million yen	95%

As described below, compared to similar projects, this project is considered to have been efficient in terms of cost-effectiveness.

The costs per one ha including construction consultant costs, soft component costs, facilities/equipment procurement costs is 350,000 yen, and aid assistance was comparable to the 390,000 yen (at the time of basic design) of the "Project for Afforestation for Conservation of Up and Middle Streams of Huang He in the Ningxia Hui Autonomous Region" (2001-2003). At a planting cost of approx. US$1,000 / ha, it is comparable to the $1,088/ha of the World Bank loan project "Forest resource development and protection project" (the 5th starting in 2010), and compared to the US$700 /ha of the yen loan project "Shanxi afforestation project", it is higher by 40%.

As will be mentioned in the section on effectiveness, forest results such as the survival rate and conservation rate are influenced by whether or not necessary amount of investment was made. In order to ensure good planting in semi-arid areas such as Loess Plateau, an amount such as that above would be necessary.

3.2.2.2 Project Period

In the basic design survey, the optimum project period was deemed approximately 60 months. The actual length was 57 months (95% of the plan), from March 2003 (E/N date) to November 2007. The project period of each term is outlined below, and for each the actual period was shorter.

Table 3 Project period of each term

	E/N	Project period (planned)	Completed (actual)	Project period (actual)
1st term	March-2003	13 months	March-2004	12 months
2nd term	August-2003	21 months	December-2004	17 months
3rd term	July-2004	21 months	November-2005	17 months
4th term	June-2005	21 months	November-2006	18 months
5th term	June-2006	21 months	November-2007	18 months

As described above, both project cost and project period were within the plan, and therefore efficiency of the project is high.

3.3 Effectiveness (Rating: ③)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

(1) Forest cover rate improvement

Out of the 8,385.9 ha in 4 counties, four areas, 71.3% was denuded land, and only 8.3% or 697.8 ha was forest cover. At the time of evaluation, forest cover was 66.4%, almost reaching the target value of 66.8%. The reason for this slight dip below the target value was the below average results of the management simplification technical demonstration stand in Daning where the growing stage was not reached, and the survival rate of showcase stands except for Jixian falling below 80% of the target.

Table 4 Forest cover rate for areas covered by projects

(units: ha)

Project area	Before project implementation (2002)		At the time of evaluation (2011)	
	Forest	Forest cover	Forest	Forest cover
8,386	697.8	8.3%	5,572	66.4%

Sources: Prepared by the external evaluator, based on the basic design survey report, JICA documents, and information submitted by the Shanxi forestry department

Note 1: Forest cover rate=forest area/land area x 100

Note 2: The forest area after the implementation of the project includes the dimensions of the planted stands, the road next to the planted stands, the showcase stands, etc.

In terms of the success of planted stands, the main indicator, survival rate was 95%, well above the target rate of 85%. It was relatively high compared to the 2006 "Conversion of cultivation land to forest cover land project" survival rate of 85%[21] and the "Shanxi

[21] Shanxi Publishing Organization/Shanxi Scientific Publisher "Process Afforestation theory and practice", (2007) p. 340

afforestation project" (yen loan project) survival rate of 85%[22]. Even Daning techniques dissemination model stand showed a remarkable 98% survival rate, higher than the 3 other counties' average.

The reason for the high survival rate can be summarized in 3 points: 1) The fact that such a thorough China/Japan plan was drawn up was due to past technical cooperation and proven conservation/afforestation techniques with planting methods appropriate to denuded land 2) at the implementation phase, the business units were adequately set and the necessary funds invested, 3) operations on site were according to plan and specifications/standards. The construction consultant in Daning advised the farmers directly as part of a practical training program, and the program was highly evaluated for following the correct procedures and being logical.

(2) The growth conditions for tree varieties

To effectively grasp the actual growth of the type of trees planted, to the extent possible in the four target counties, sample surveys of tree height and survival rate were carried out. As shown in Table 5, the growth of each type of tree used was favorable. The average values calculations for the 4 provinces were as follows: Aburamatsu (Pinus tabulaeformis Carr.) at seedling height 14cm were 178 cm (5th year seedlings/ planted 2006), 189 cm (6th year seedlings/ planted 2005), and 202 cm (7th year seedlings/planted 2004); oriental arbor vitae were each 189 cm, 202 cm, 284 cm, and Robinia pseudocacia were 390 cm (5^{th} year seedlings), and 584 cm (7^{th} year seedlings). These excellent growths are apparent if compared to the oriental arbor vitae in the technical cooperation model stand in Jixian (130 cm for 5^{th} year seedlings, 150 cm for 6^{th} year seedlings and 180 cm for 8^{th} year seedlings)[23] and to the Robinia pseudocacia in the neighboring Suide County, Shaanxi province (290 cm for 5^{th} year seedlings, 300 cm for 6^{th} year seedlings and 370 cm for 7^{th} year seedlings).[24]

The basis of good growth is first of all, ground leveling work before planting. Construction consultants and contractors took into consideration terrain conditions, combined various land leveling methods and provided guidance and thoroughly checked that it was according to plan and the land was well balanced and level. The vitality of semi-arid land after planting was successfully achieved through guidance on checkpoints including: whether or not good quality nursery stock was secured, that the stock would not dry out, and a snug fit between roots and earth was done with care.

It was feared that the target recovery of vegetation according to the plan would be hampered

[22] Shanxi Province Forestry Department
[23] Beijing Forestry University
[24] "Study on Relationship between Growth of Artificial Robinia pseudoacacia Plantation and Soil Desiccation in the Loess Plateau of Northern Shanxi Province", Li Wang (Institute of Soil and Water Conservation, Chinese Academy of Sciences et al in "Scientia Silvae Sinicaee" Vol. 40 (2004)

by livestock overgrazing causing feed damage. Causeway damage and damage to sprouts by livestock overgrazing was indeed observed during the project implementation period. However, between 2007 and 2009 a ban was placed on livestock grazing in Shanxi, and it was strictly administered, and as a result, significant vegetation recovery was observed with livestock damage virtually eliminated. Some damage by field rats can still be seen, but the survival rate after planting three years of all tree varieties is over 92%, a rate much higher than the 78% survival rate after planting three years achieved by a Germany-assisted afforestation project implemented also before the ban. [25]

Table 5 Growth conditions by tree species for the project area

Year planted	Age of stand	Tree species	Seedling Height	Tree Height	Survival rate after planting three years
			(≧cm)	(cm)	(%)
2004	7 years	Aburamatsu	14	202	98.8
2005	6 years			189	100
2006	5 years			178	96.7
2004	7 years	Thuja Orientalis	45	284	100
2005	6 years			202	99.5
2006	5 years			189	99.5
2004	7 years	Robinia pseudoacacia	30(120)	584	98
2005	6 years			N/A	N/A
2006	5 years			390	92.3

Source: the evaluator based her work on the sample survey,

Note 1: the survey was done based on the kind of trees, year planted and the average was calculated for conifers' area of 120 m^2 and for broad-leafed trees' area of 160m^2

Note 2: Robinia pseudocacia seedling height was higher than 120cm but they were clipped to 30 cm and then planted.

(3) Condition of showcase stand

The showcase stand was created to stimulate farmers' incentive. According to JICA documents, regular growth was observed for 8 tree species, but according to field observation within this evaluation survey, with the exception of Jixian, the growth of most tree species was substandard. According to the County forestry bureau, there is always the possibility that new species do not match the soil. As for the survival rate after planting three years of the

[25] Shanxi Publishing Cooperative Shanxi Scientific Techniques Publishing Co. "Process Afforestation Theory and Practice" (2007)

following trees: peach, amygdalus persica, Myrica Rubra, Prunus Armeniaca, jujube, Corylus Heterophylla, there is a variation by province of quadrapoid Robinia pseudocacia, there is variation from County to County and Jixian, where farmers are carrying out maintenance management, showed good results. As a result, it is too early to determine whether the land is appropriate for the new tree species. Hereinafter regarding planting of different tree species according to farmers' needs, it is desirable to stimulate the incentive to plant such forest land, which can then be used as a showcase stand.

3.3.2 Qualitative Effects

The expected effects of this project are 1) improvement of dissemination agents' technique dissemination techniques, and 2) thus contribute to development of farmers' afforestation initiatives 3) spread an effective dissemination model to similar sites which have proven viability and 4) the raising of the entire area's incentive for planting. To verify the effects of this initiative as part of the ex-post evaluation, 107 dissemination agents of the forestry department, the County forestry bureaus, ward forestry stations, and approximately 92 farmers in 4 counties were surveyed as beneficiaries using questionnaires. The target participants are broken down into the groups indicated in the table below.

The results show that the dissemination agents' planting techniques dissemination abilities improved and that dissemination activities were stimulated by the project. The dissemination also greatly contributed to farmers' incentive to plant, their technique, as well as the progress of planting initiatives in general.

Table 6 Breakdown of beneficiaries for dissemination agents

(units: persons)

Affiliation	Forestry Department	Daning	Xixian	Puxian	Jixian	Ward	Total
Dissemination agents who received training	12	17	23	18	18	4	92
Dissemination agent who, as Instructor, implemented	3	8	2	0	2	0	15
Total	15	25	25	18	20	4	107

Note: the word instructor here means person who gave training and on-site instruction to dissemination officers after being trained to be an instructor by Japanese consultants. The training for this project during implementation phase was centered around the Japanese consultant, two individuals from the forestry department, and two persons from each County for a total of 10 people, and the forestry department dissemination agents also provided guidance on site.

Table 7 Breakdown of beneficiaries for dissemination for farmers

(units: persons)

Affiliation	Daning	Xixian	Puxian	Jixian	Total
Farmers who received	32	13	17	12	74
Farmers who weren't trained	4	9	5	0	18
Total	36	22	22	12	92

Note: Training means training/seminars conducted during implementation of the project

(1) Planting techniques dissemination improvements

Regarding transformations in planting techniques dissemination skills, 46.7% of dissemination agents replied "improved significantly", 53.3% replied "improved somewhat", and overall the self-evaluation in this respect was positive. Regarding becoming able to operate independently, 58.9% of the total credited "counseling onsite during supplementary planting", 53.3% credited "design of training plans". As for the instructors, 86.7%credited "counseling onsite during supplementary planning", "counseling during planting apprenticeships", and "nurturing of planting technique dissemination counselors". As for Daning instructors, 87.5% or more credited "design of training plans", "curriculum design", "design of teaching materials", "planting techniques dissemination agents nurturing", "implementation of classes", "counseling during ground leveling activities", "counseling during supplementary planting", and "planting counseling during apprenticeship training". Japanese stationed locally have confirmed significant increases of capacity in a variety of fields. Regarding "on-site ground leveling counseling" and "planting apprenticeship counseling", namely, capacities required of dissemination agents charged with the responsibility to spread techniques to farmers, only 5.9% and 18.5% of all respondents gave positive answers respectively; continued training appears to be in order.

Less than 10% of respondents indicated becoming able to provide counseling at awareness seminars and showcase stands independently, a rather low success rate. That significant skill improvement was not observed for items for which there was no training component is proof that targets recognized training as useful for improving dissemination techniques.

(2) Progress in farmers' planting activities through technique dissemination

Dissemination activities increased after implementation of the project, which is demonstrated by the fact that all dissemination agents responded "showed significant increase" or "increased somewhat". 72.9% of dissemination agents responded that farmers' planting activities "progressed significantly" and 26.2% responded "increased somewhat" and together these two groups make up 99.1 %. As for the reason for progress in farmers' planting activities encouraged by dissemination agents' activities, farmers indicated incentive increases due to the desire to see a rise in income and to see prevention of soil runoff.

As for the survey of farmers, 65.2% indicated that planting activities “progressed significantly” while 29.3% responded “progressed somewhat”, adding up to a total of 94.5%. In terms of the effects on 1) increased interest in planting 2) planting technique, and 3) the difference in the number of people with experience and those without, a difference was observed when comparing farmers who participated and those who didn't. For the first item above, 66.2% of farmers who participated said “increased significantly” compared with 38.9% of non-participants.

For the second item, 66.2% of participants indicated “increased significantly” or “increased somewhat” compared to 16.7% of non-participants. 3) 86.5% of participants indicated having experience compared to 61.1% of non participants. So 25-50% difference was seen in terms of training levels. It can therefore be considered that the training as part of the project increased interest in planting and technical ability.

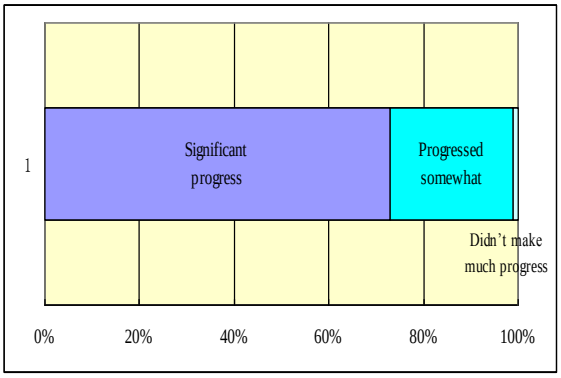


Fig. 8 Progress in planting due to farmers (dissemination agents)

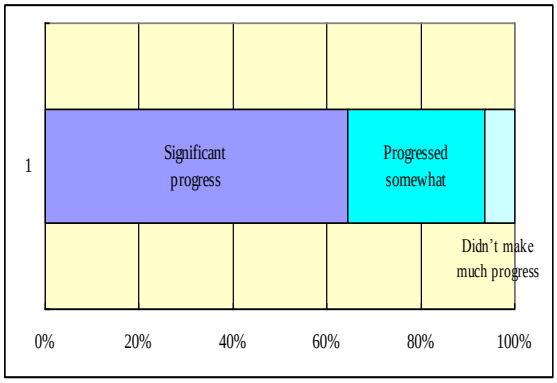


Fig. 9 Progress in planting due to farmers (farmers)

(3) Influence of effective dissemination model on similar regions

As Figure 8 shows, there is a significant difference over previous projects in terms of “planting operations/supervision of works.” As stated previously, this difference translated into a difference in planting results. The survey results show that the model had influence inside and outside Shanxi Province and there was a disparity in the degree of influence

According to the survey sheets submitted by dissemination agents, 41.1% indicated that the effect of the dissemination model on related areas was “significant”, 57.9% responded “somewhat”, for a total of 99%, and this influence was not only for the target 4 counties, but for Shanxi as a whole.

According to the interview with Shanxi Forestry Department officials, this project was highly evaluated, and served as a model of planting /supervision of works/dissemination for the Three North forest reserves construction project within the province, the denuded mountain greening project by the Shanxi Government itself (one of the 6 large-scale planting forest projects),

County-level roadside greening projects and ring road greening projects. In terms of general afforestation, general planting supervision was introduced as a model, and in addition to supervision for denuded land, planting techniques and planting labor were also adopted. The span of application of the latter is of approximately 110,000 ha per year[26]. The model dissemination started in 2010 with the JICA technical cooperation project "Promotion of the Dissemination of New Technology for the Loess Plateau Forest in China" encompassing seven provinces on the Loess Plain, and hereinafter it is expected to have a larger impact on the yen loan project locations in and out of Shanxi Province.

(4) Increased incentive in the entire area

The plan was drawn out to involve farmers by applying planting techniques they could use so that the local people could understand and cooperate. The plan was carried out steadily by those who had highly motivated townships selected for the trainees. These two points contributed greatly to the result.

It should be noted that the number of respondents indicating a desire to be involved in planting activities was 95.9% for those who participated in training and 83.3% for those who didn't, both quite high. "Forest land group ownership system[27] reform" was implemented in 2008, and in the target areas, factors such as group-owned forests being split up and conceded to individual farmers, with they themselves becoming capable of managing and operating them, and with support such as government seedling distribution / technical support being enabled, influenced the improvement of the area for which planting took place. Farmers understood that commercial forests would be conducive to higher incomes and this could be considered a contributing factor.

In Lingtou Township, Daning it was demonstrated in interview format surveys that commitment to planting and maintenance of nurturing of stands is spreading throughout the entire township. With the township leader's cooperation, trust was built up between all interested parties including experts and counterparts. On this basis, training was implemented, and local farmers were able to engage in planting activities independently. In addition, through awareness seminars targeting elementary and junior high school students, the importance of forests was thoroughly communicated throughout the entire area. Even upon termination of the project, approximately half of dissemination agents continued awareness seminars. From the long-term

[26] Approx. 270,000 ha are planted in Shanxi Province every year. Expressed in terms of 2010, out of planted land area of 29,000 ha, 170,000 ha are in the national budget, 120,000 ha are in the provincial governmental budget. Within the provincial government budget, the land area of the model ecological forest that was adopted was estimated at 110,000 ha, or 94%. (Shanxi ForestryDept)

[27] Forest land group ownership refers to possession of planted land and denuded land (to be planted) and use of these latter. These rights of use are transferred to local residents and the latter develop a sense of responsibility for managing the lands, and the result is that their incomes increase. The maximum ownership period is 70 years.

perspective, passing this on to the future generation that is charged with maintaining the forests will contribute greatly to afforestation efforts.

This project has largely achieved its objectives; therefore its effectiveness is high.

Table 8 main differences between prior methods and this project model

Item	Sub-Item		Before project implementation	During Project implementation
afforestation program *	ground leveling (Providing for a process to ensure percolation of rainwater into the soil as preparation for planting)		small ditch ** flat ditch*** etc. Features: 1. Constructing ridges with topsoil 2. soil remains in ditch 3. ridges are not firm enough 4. there are many shallow and narrow areas	Using flat ditch mainly, but choosing small ditch) if matching the shape of the land Features: 1. filling in ditch with upslope soil 2. Making ridges with soil 3. tamping for making strong ridges 4. implementing ground leveling as planned
	nursery stock	selection	Coniferous tree: Two to three year-old first or second class bare root seedlings and one year-old pot seedlings Broadleaf tree: One year-old first or second class bare root seedlings	Coniferous tree: Two year-old first class pot seedlings Broadleaf tree : One year-old first class bare root seedlings
		transportation method	Transport without bags	Transport with bags
	nurturing	weeding	No implementation	Implementation up until the third year
		tilling ditch soil	No implementation	Implementation up until the third year
		mulching	No implementation	Partial implementation
		branch selections	No implementation	Implementation
construction supervision	plan		Rough planting plan only, so small groups not set in detailed fashion. No forest road, observation tower or staff room	Detailed planting plan with small group units set. Existence of forest road, observation tower or staff room.
	quality control		Forestry department carries out planning, implementation, inspection. No supervisors	Change in implementation staff → new bidding at each planning, implementation, inspection stage. In this project Plan – drafted by construction consultant and China side Planting – implemented under supervision by construction consultant and construction staff Inspection – implemented under supervision of construction consultant and Shanxi Forestry Department
	Inspection		Desk checking is the base. Take rough samples. Has onsite inspection experiencem	Implement on-site inspection of 20% of small groups
Dissemination agents	Training method		Indoor classroom only	Combination of Indoor class (detailed planting techniques / soil preparation / planting / nurturing) and site visits, practical training

Source: Prepared by the external evaluator, based on interview survey and basic design report.

Note: *planting work carried out by farmers. This project model is implemented by famers that meet the standards of a specialty team.

** Small ditch– this method allows for small diameter ditches to be set up where long ones are not possible because the land is sharply inclined and has shrub coverage. In China, it is called fish scales pit. In an area with thin top soil, a hole with a diameter of 40-8cm is dug, and soil is piled into the hole and then rocks on top of that. This helps store

water.

*** Horizontal ditch – this method involves setting up a ditch along the direction of the slope and following its contours. An embankment is disposed, and rainwater collected flows along the contour of the declination

3.4 Impact

3.4.1. Intended Impacts (Xinshuihe area forest cover rate improvement)

Xinshuihe basin forest area and forest cover rate improved to the extent that it reached 38% compared to the 44.65% target set out in the plan. This was possible due to the unit value increase, budget increases, adopting models and increasing survival rates after planting three years.

Table 9 Xinshuihe basin area forest area and forest cover rate

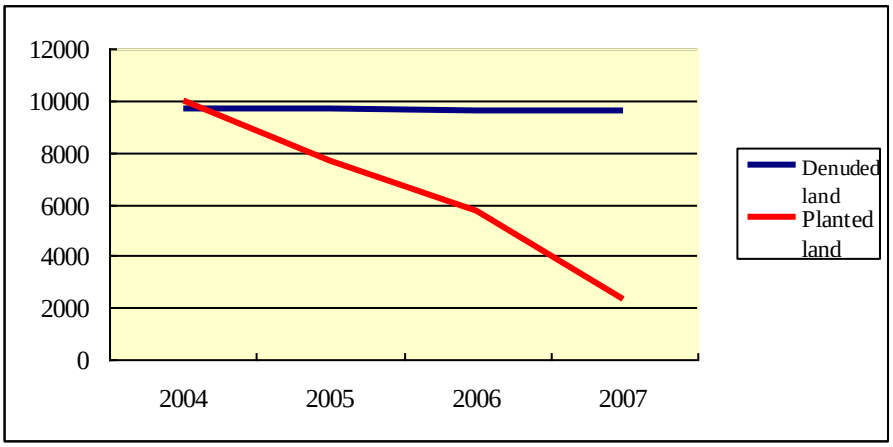
Indicator (units)	County	2001	2007	2010
Forest area (10,000 ha)	Jixian	6.9	8	8.4
	Daning	2.5	4.4	5.3
	Puxian	5.3	6.23	6.52
	Xixian	3.4	4.22	4.65
	Total	18.1	22.85	24.87
Forest coverage rate (%)	Jixian	39.1	45.4	47.6
	Daning	26	46	55
	Puxian	35.1	41.3	43.2
	Xixian	23.8	29.8	32.8
	Total	31	40.625	44.65

Source: County forestry departments

3.4.2 Intended Impacts (Xinshuihe basin sediment flow volume reduction)

As shown in Figure 10, Daning weather/sediment volume measurement center data describes a clear difference between denuded land and planted land in terms of sediment runoff. For denuded land, the sediment runoff was 9,580 tons/km^2 in 2007 compared to 2,310 tons/km^2 for planted land in the 3rd year after planting, less than 1/4. Xinshuihe basin showed dramatic improvement from a forest cover rate of 27.2% in 1998 to 44.65%, and it is likely that the effects of planting were conducive to sediment runoff decreases.

(units: tons/km$^{2)}$



Source: Daning forestry departments

Figure 10 Daning Weather/Sediment Volume measurement center

In the results of surveys of farmers, 32.6% answered that, compared to before the project implementation, sediment runoff had “decreased significantly” and 67.4% answered “decreased somewhat”. A total of 25 % of respondents answered that damage due to sediment runoff had “decreased significantly”, and 69.6% responded that it had decreased somewhat, for a total of 94.6% admitting that such damage had declined. Also, 29.3% of respondents answered that their preoccupations about sediment runoff were significantly reduced and 64.1% indicated these were “somewhat reduced”. A total of 84% of farmers indicated an awareness of sediment runoff, and that it was as big a problem as before. Be that as it may, 90% of farmers admitted the effects of reductions in sediment runoff, so the priority objective can be said to have been achieved.

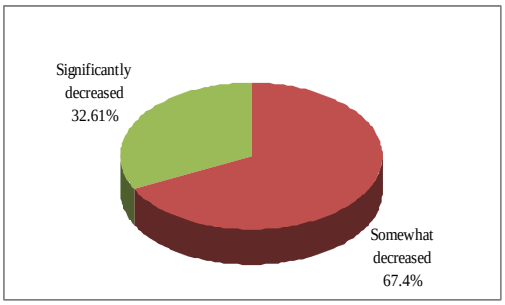


Fig. 11 Sediment runoff before and after implementation of the project

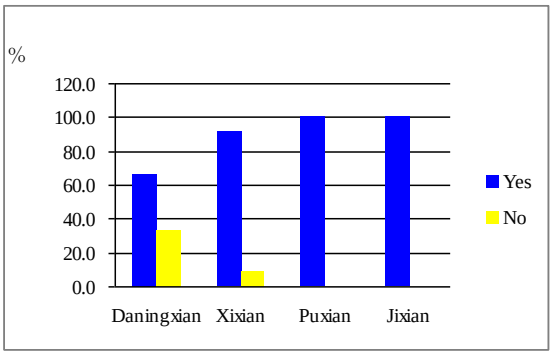


Fig. 12 Sediment runoff awareness

3.4.3 Other Impacts

(1) Impacts on policies

This project was positively evaluated by Chinese leaders and the impacts were the improvement of Shanxi forestry policies. The practical training for the soft component, the farmers, was done on a large scale, and through their training much planting was accomplished in Daning, and the communication of ideas on how to achieve high survival rates on site was another result.

The largest impact was the raising of unit planting value[28]. Unit planting value was based on the specifications or standards by type of operation as well as proper documentation, and the proper implementation was conducive to high survival rates. It has been widely accepted that the low unit planting value before the project implementation was due to specifications and standards not being met. The second policy impact was the adoption of the Plan – Do – See management system by afforestation project participants, emulating the system employed in this project. Now, projects involving more than 50,000 Yuna procurement are required to employ competitive bidding at the planning stage and verification of afforestation outcome is required in ex-post evaluation.

(2) Relocation of residents / land acquisition

Because the target of this project is denuded land, there was no relocation of residents; however, the Chinese side shouldered 2 million Yuna in site acquisition costs.

Not only were Xinshuihe basin area forest cover rates improved, the effects of this project extended widely, thus contributing to the advancement of Shanxi afforestation policies. The planting model for this project is spreading throughout Shanxi province and through the Loess Plateau generally, so its influence can be considered high.

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspects of Operation and Maintenance

The implementing agency, Shanxi forestry department has 2 offices, 11 sections and 1 committee (76 employees) that are controlled directly as well as 32 agencies and 9 forestry bureaus that are responsible for operations. The Department oversees 11 city/ward forestry bureaus, 120 County forestry departments and 2,400 small and medium-sized forestry stations.

Project liaison office and Daning liaison station were established to manage the project at the beginning, but were removed at the end of the project; however, there was no major change in

[28] Before this project, unit planting value was 100-200 Yuna / *mu*, however it climbed to 500 Yuna in 2007

Shanxi forestry department and there was no problem with operations and maintenance management. At the time of evaluation, the foreign cooperation office was responsible, along with the operations and maintenance sections of the four counties, for this project.

The numbers of officials at the forestry bureaus were 94 in Jixian, 103 in Daning, 230 in Puxian, and 120 in Xixian. As for operations and maintenance management, in Xi and Daning, it was conducted by "Forest office", in Puxian by "Natural forest conservation desk", in Jixian by "management conservation station", and patrol of planted lands was carried out by township conservation officers. During the planning phase, more than 4 full-time conservation staff members were to be stationed; however, during at the time of ex-post evaluation, there were 5 resident conservation officials in Xixian, 5 in Daning, 3 in Puxian, and 3 in Jixian. Because of budgetary constraints, the problem of understaffing had not been corrected, and instead the individual conservation officials patrol wider areas. At some conservation staff stations, cameras are set up, enabling early warning for forest fires, Non-resident County forestry bureau officials are also dispatched, so at present there is no major problem.

3.5.2 Technical Aspects of Operation and Maintenance

In the section on effectiveness, because planting techniques dissemination officials' skill is improving, and since training and on site counseling are in place for further improvement, there are no problems foreseen in terms of maintenance. However, since there is a lack of experience in nurturing and protection, and since disease damage/pests removal are conducive to tree growth, timely training must be implemented as new work becomes necessary.

No manuals regarding planting operations and construction supervision methods such as ground leveling, planting, support planting, nurturing and protection, etc. have yet been prepared in document forms. Presently individuals come into contact with operations through dissemination activities. Hereinafter, maintenance management manuals should be created and widely distributed to the relevant individuals so that dissemination occurs thoroughly within the province and throughout the Loess Plateau generally.

3.5.3 Financial Aspects of Operation and Maintenance

The forestry department afforestation budget has increased significantly from the planning phase, and the 2009 budget was 6.8 times that of 2001.Though there is a variation for target counties, all the counties' budgets for 2009 surpassed the amounts foreseen in the plan. That being said, most of the budget is allocated for planting, not for nurturing, protection or supervision. The maintenance management cost for the counties was only around 300,000 to 400,000 Yuna, or 2 to 8 % of the budget as a whole and it covers mostly the personnel cost of the conservation staff.

Table 10 Forestry department and Forestry bureaus budget

(units: 10,000 Yuna)

	2001	2005	2006	2007	2008	2009
Shanxi forestry department	92,000	180,000	300,000	600,000	610,000	630,000
Jixian forestry bureau	450	890	760	900	1,038	846
Daning forestry bureau	320	290	135	175	932	480
Puxian forestry bureau	600	530	720	870	830	950
Xixian forestry bureau	530	900	1,050	1,100	1,200	1,300

Source: Shanxi Forestry Department and County forestry departments

With the aims of increasing forest cover and to improve the quality within the "Shanxi forestry ecologic construction general plan" (2010), for the first time 18.9% of the budget was allocated to maintenance management. This merits a high evaluation for maintainability. Hereinafter, there will be a need for branch trimming and tree thinning for sound tree nurturing and land and water conservation, disease prevention and pest elimination, small animal damage control as well as human damage control such as illegally cutting down trees, forest fire, grazing, and etc.. There is a need for early securing of the budget for maintenance management and for preparation for the operation manuals.

3.5.4 Current Status of Operation and Maintenance

Planted land was granted in lump format by the Japanese government to the Chinese government in 2007, and the 2008 – 2009 nurturing plan, except for Xixian, was mostly according to plan. However, due to chronic budget shortages, the focus from 2010 onwards will have to be on patrols by conservation staff, and growth monitoring will be insufficient. Growth plan development, securing of budget and preparation of monitoring system are needed.

The facilities and equipment maintenance within this project were mostly acceptable, however, weather/sediment volume measurement station, project introduction boards, wireless sets, back pack portable sprayer devices, and fire extinguishers were partly not in use. At Shanxi weather/sediment volume measurement station a construction permit was not obtained at the planning stage, so at the end of the project, weather observation/measurement devices were removed. The wireless set was replaced by cell phone at the end of the project. Fairly heavy use was foreseen for the vehicle from the beginning but because the meter inside showed it was approaching the limits of durability, it was not used for certain parts of the project.

As described above, while some minor problems have been observed in the structural,

technical and financial aspects of operation and maintenance, the implementing agency is fully capable of addressing these problems and no major problems have been observed in the operation and maintenance system, therefore sustainability of the project effect is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

As part of the China's national afforestation plan that has as its aim increasing forest cover rate, this project was implemented as a tree planting model for the creation of shelter belts on the Loess Plateau with its desolate denuded land and unfavorable site location. Carefully considering local conditions, a basic design was drafted, and based on this work it was rigorously implemented, and this led to high survival rates. Incorporating farmers from the planning phase and using the soft component and ensuring training of dissemination officials and farmers also contributed synergistically to the success of the project. The afforested area created successfully in this project was highly evaluated, which led to the raising of Shanxi unit planting value and other improvements in policy as well as to the progress in afforestation over the entire area. Hereinafter in order to be maintained as a highly successful afforested area and to be used as a model for afforestation in the Loess Plateau entire region, it will be important to ensure appropriate forest nurturing and protection based on the state of tree growth

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

(1) In order to maintain the projected areas as well planted stands, sufficient nurturing and forest protection, such as pest preventing measures, animal damage control, and human damage control should be given at proper times. The maintenance program for the five years should be made as soon as possible based on the 12th five-year-plan, so that the budget can be secured. It is requested that the systems for monitoring the growth and nurturing and forest protection operations be prepared.

(2) The result of this project is highly valued and the operation has begun to be adopted in similar areas within and outside of Shanxi. In order to be widely adopted, there should be a bigger focus on public relations activities and adequate ways and means to communicate the contents easily and correctly will be needed. At present, there are no manuals, no guidelines or other documents showing the key points or procedures of planting operation, supervision of the works, dissemination activities, nurturing and protection. Easy manuals with a lot of photos and illustrations should be prepared, delivered and used widely. This will not only make clear the

standards for models but also lead to planting higher quality stands with enhanced effectiveness.

(3) Showcase stands should be re-created and utilized in order to encourage the local farmers to plant trees. If economic trees such as fruit trees as well as ecological trees are planted and then proper operations including good maintenance are provided, good economic effect will be shown in rather short period. Such showcase trees presenting good examples will motivate the farmers and encourage them to plant trees. The project "Promotion of the Dissemination of New Technology for the Loess Plateau Forest in China" that targets seven Loess Plateau provinces includes an inspection tour of the project areas of this project under evaluation. In several years the showcase trees with high exhibition effect will be utilized as inspection tour sites.

(4) The facilities and the equipment developed in this project should be constantly maintained and treated more carefully. Some of the forest lanes, which play an important role in patrolling, monitoring of the tree growth conditions and providing access in emergencies, were found to be not accessible. Indispensable equipment such as sprayers and fire extinguishers were not installed in some places. After the life span of a given piece of equipment is over it is necessary to apply for disposal to properly get rid of it. Then records should be kept in the maintenance record book.

(5) From now on the main planting areas for the purpose of conservation of water and soil will be waste land in bad geographical conditions. There is no data on tree growth after planting nor the amount of soil erosion, and no research has been conducted on the effect of water and soil conservation. In order to enhance the effect of this project and accomplish the long-term purpose of water and soil conservation, first the tree planting areas of this project should be used as planting samples and necessary data should be regularly monitored. That data should then be utilized in later research.

4.2.2 Recommendations to JICA

In this project, tree planting techniques suitable for the waste land and the operating methods were developed on the basis of the soil conservation techniques researched and established through the past technical cooperation projects. These methods are now being widely adopted in areas with similar conditions as model projects. As the model project, it is important to ensure that the effect of this project be sustained. Long periods of time will be necessary for creating forests and therefore an agreement was made between the two countries that China will nurture the trees after the minimum care is applied in project form. It may be desirable that Japan should examine on an as needed basis the nurturing and control measures by China, and support the

nurturing as a model using the JICA follow-up scheme.

4.3 Lessons Learned

This project achieved planting survival rate of 95%, a very high achievement. It was shown that even in the Loess Plateau Xinshuihe area with its steep inclines, which is vulnerable to denuding, and where loess accumulates very thickly, afforestation is not impossible. The main reasons for success are operations supervision at the planning and implementation phases. Through thorough surveying of varieties of tasks, the volume for each, specifications, standards at the planning stage, China and Japan were able to draft deliberate drawings. As a result implementation taking into consideration the proper timing based on plant organization was possible, and only the minimum of changes at the detailed design level were required. At the implementation phase, high quality was obtained through accurate and timely investment of the required funds according to the elaborate drawings. At the detailed design stage, changes and adjustment were made according to the changing conditions in terms of ground clearing methods and tree varieties as well as the number of trees planted and the area of plantation.

In addition to the rigorous supervision of works, the incorporation of famers in the project smoothed the implementation process and increased the effectiveness. To ensure that there was an understanding of the value of forests to the regions, the plan was formulated with direct participation of farmers, through training and awareness seminars in the operation of planting enterprises.

In terms of the achievements of the program, the soft component played an especially large role, and through a combination of planting activities and training and supervision by Japanese consultants, effective dissemination was carried out. If there hadn’t been the aim to increase farmers’ planting techniques and awareness, the precise afforestation work and the high survival rates achieved would not have been possible.

As was shown above, the incorporation of the soft component synergistically led to increased effectiveness, and this should be considered a successful model for future afforestation projects.

End.