

People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan Project  
“Ningxia Afforestation and Vegetation Cover Project”

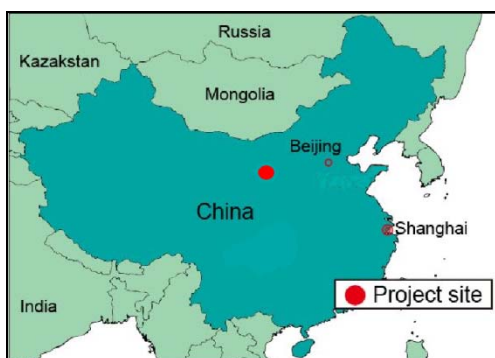
External Evaluator: Makiko Soma, Global Link Management Inc.

## 0. Summary

Situated in the Yellow River basin of Northwestern China, Ningxia Hui Autonomous Region, hereinafter referred to as Ningxia, is one of the areas with the severest precipitation scarcity throughout China. Controlling desertification by increasing forest and vegetation cover had been an urgent task for environmental protection of Ningxia. Poverty ratio in Ningxia had been higher than in the entire China, thus, there was a substantial need for assistance in poverty alleviation through plantation activities by the local farmers. This project was highly consistent with China's national development programs, local development needs as well as Japanese ODA policy; therefore relevancy of this project is high. The project has largely achieved its objective of increasing forest cover ratio and fenced grasslands' vegetation cover ratio; therefore its effectiveness is high. The planted economic forests and medicinal herbs have contributed to increase the income of the farmers; therefore its impact is high. Both project cost and project period were mostly as planned; therefore efficiency of the project is high.

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

## 1. Project Description



Location of the Project Site



Protective Sand Fixation Forest, Zhongwei

### 1.1 Background

Northern part of Ningxia is one of the least precipitated regions throughout China. Forest cover ratio in 2001 was 8%, roughly half of the national average, and the vegetation had been severely degraded. Under such harsh environment, uncontrolled logging, grazing and land exploitation had further accelerated desertification and threatened the people's livelihood.

According to the statistical survey in 2000, annual per capita income in the rural area of Ningxia was 1,724 RMB, about three-fourth of the national average. Poverty ratio of the Project sites had reached 10%, while it had been 3 % for all over China. The poor tended to overexploit natural resources for livelihood, which led to a vicious cycle of poverty and environmental degradation. Desertification had been one of the serious factors that had restrained the sustainable development of social-economy in Ningxia, thus its control by afforestation is an important and urgent task in environmental protection in the region.

## 1.2 Project Outline

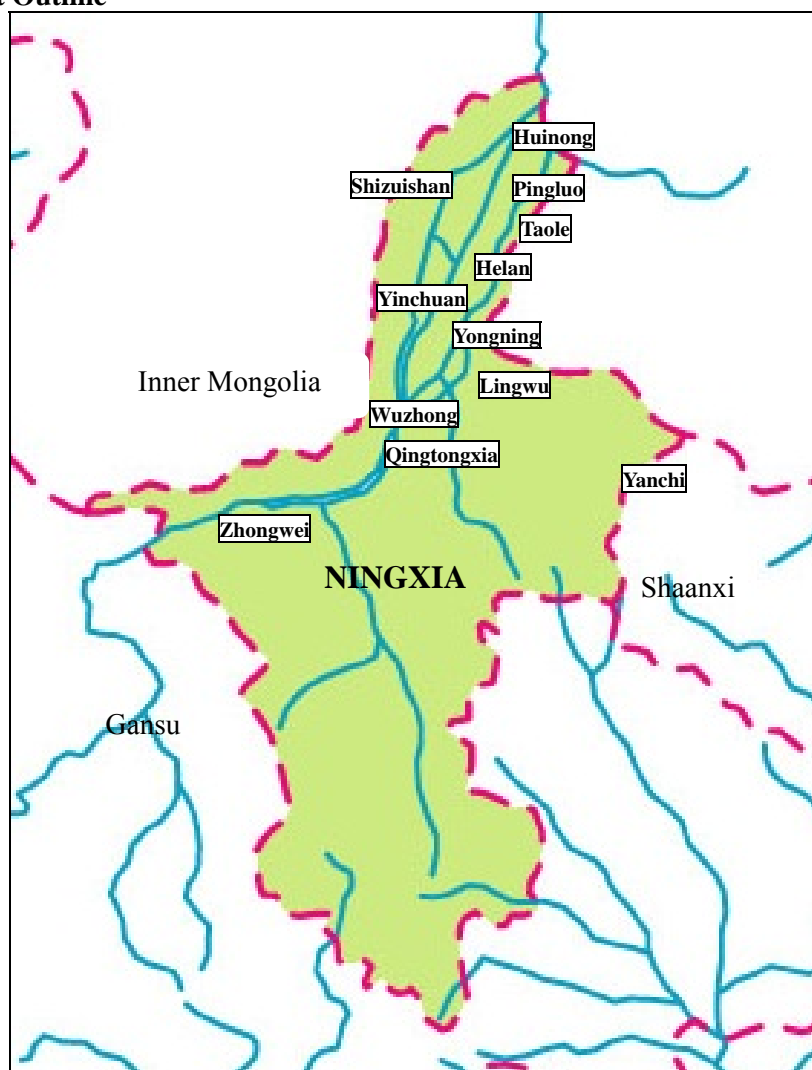


Figure 1 Map of project area (Project Areas are specified in squares)

Loan Approved Amount/ Disbursed Amount	7,977 million yen / 7,977 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March 29, 2002 / March 29, 2002
Terms and Conditions	Interest Rate: 0.75 % p.a. Repayment Period: 40 years (Grace Period 10 years) Bilateral-tied
Borrower/ Executing Agency	People's Republic of China / Ningxia Hui Autonomous Region Government
Final Disbursement Date	July 27, 2009
Main Contractor	None
Main Consultant	None
Feasibility Studies etc.	Feasibility Study conducted by Ningxia Academy of Forestry Planning and Design (2001)
Related Projects	JICA: Forest Protection Research Project in Ningxia-Hui Autonomous Region (1994 – 2001) JICA: The Project for Afforestation for Conservation of Middle Stream of Huang He (2000 – 2003)

The objective of this project is to increase forest cover and vegetation cover of the project sites by planting trees, shrubs and medicinal herbs; thereby controlling desertification in and around the project sites and contributing to poverty alleviation through the local people's participation in the plantation activities within 12 counties/cities in the northern part of Ningxia Hui Autonomous Region.

## **2. Outline of the Evaluation Study**

### **2.1 External Evaluator**

Makiko SOMA, Global Link Management Inc.

### **2.2 Duration of Evaluation Study**

This evaluation study was conducted in the following schedule.

Duration of the Study: July, 2011 – September, 2012

Duration of the Field Study:

October 9, 2011 – October 22, 2011

February 21, 2012 – March 2, 2012

### **2.3 Constraints during the Evaluation Study**

In consultation with the Ningxia Hui Autonomous Region, five cities/counties were selected for the beneficiary survey and site visits among the 12 target cities/counties. The five cities/counties are namely, Lingwu, Zhongwei, Wuzhong, Yinchuan, and Helan. Therefore, the results of the field study might not represent the situation of all target areas.

### **3. Results of the Evaluation (Overall Rating: A<sup>1</sup>)**

#### **3.1 Relevancy (Rating: ③<sup>2</sup>)**

##### 3.1.1 Relevance with the Development Plan of China

In 1998, China State Council approved the “National Ecological Environment Construction Plan” to set the national framework of environmental conservation in the sectors of forestry, water utilization, agriculture and natural environment. The plan is divided into a short-term plan until 2010, mid-term plan until 2030, and long term-plan until 2050 to mitigate soil erosion, to conserve desertified land, and to increase forest cover etc. The short-term plan specifies the “lower and middle Yellow River basin,” “upper and middle Yangtze River basin,” “desertified area” and “steppes” as four priority areas. Ningxia belongs to the above “desertified area,” on which this project took measures of plantation of protective sand fixation forest, economic forest, grassland formation and fencing closure.

Chinese government had continued to promote “National Ecological Environment Construction Plan” in its Eleventh National Five Years Plan (2006-2010) and prioritized environmental protection activities such as conversion of degraded farm land into forest/grass.

China’s Twelfth National Five Years Plan (2011-2015) sets out the realization of environmentally conscious society. It aims at natural forest protection, conversion of degraded farm land into forest/grass, prevention of desertification, conservation of soil and water, protection of wetland, sand fixation, and conservation of biodiversity to prevent and mitigate natural disasters.

To address poverty, Chinese government has been carrying out “China Western Development,” a fifty-year policy to redress the disparity between the eastern waterfront district and inland, since 2001.

In Ningxia, sustainable development with harmonization of economy, society and environment had been stipulated in its Eleventh Five Years Plan (2006-2010). Along with the plan, the government carried out programs and projects on natural forest protection, conversion of degraded farm land into forest/grass, protective forest plantation, wetland conservation, designation of natural reserves, as well as soil and water conservation.

In Ningxia’s Twelfth Five Year Plan (2011-2015), afforestation, grassland protection and prevention of desertification have again been placed emphasis. Under the plan, aesthetic forests and protective forests have been established in the “Green Great Wall” project. Wetland rehabilitation, designation of comprehensive desertification prevention areas, and

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<sup>1</sup> A: Highly Satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>2</sup> ③: High, ②: Fair, ①: Low

grassland protection projects have also been carried out pursuant to the plan.

As stated above, at the times of both appraisal and ex-post evaluation, the objectives of the Project were in line with these national and regional policies of China and Ningxia that aimed at increasing forest and vegetation cover as well as improving the livelihood of the local populace.

### 3.1.2 Relevance with the Development Needs of China

Northern Ningxia is one of the areas with the severest precipitation scarcity throughout China. In 2001, forest cover was only 8% of the total land area and the land had been severely degraded due to uncontrolled logging, grazing and land exploitation. In addition to such harsh environment, the region embraced large number of rural population, thus, various projects had been carried out for livelihood improvement, securing of drinking water, and assistance for farm production.

At the time of ex-post evaluation, Ningxia Government was executing “Ningxia Central Dry Zone Development Project (2007~2011)” to cover the 67,367 ha of arable land with vegetation and to increase the forest cover ratio of Yanghua Irrigation district up to 15-20%. In Ningxia, the population under poverty line had decreased significantly from 959,000 in 2001 to 168,000 in 2009; while rural population, on the other hand, did not see a drastic decrease. In 2001, the rural population was 4.12 million and accounted for 73% of the total population; and in 2009, it was 3.88 million and still accounted for 63% of the total population in Ningxia.

At the times of both appraisal and ex-post evaluation, the objectives and approach of the Project to cover arable land with vegetation to prevent desertification as well as to improve the livelihood of the local people were in line with the development needs of the region.

### 3.1.3 Relevance with Japan’s ODA Policy

In “Economic Cooperation Program for China” and the “Strategy for Overseas Economic Cooperation Operations,” both laid out by Japanese government, environmental protection, poverty alleviation, and livelihood improvement of the inland were emphasized as priority issues. Therefore, this Project is consistent with aforementioned Japanese policies.

This project has been highly relevant with the country’s development plan, development needs, as well as Japan’s ODA policy; therefore its relevance is high.

### 3.2 Effectiveness (Ratings: ③<sup>3</sup>)

#### 3.2.1 Quantitative Effects (Operation and Effect Indicators)

##### (1) Forest cover ratio / Vegetation cover ratio

The land area of the project sites in 12 counties/cities is 818,978 ha. Before the launch of the project in 2001, forest cover ratio of the area was 6.9% (56,401 ha) and fenced grasslands' vegetation cover ratio was 30%. As shown in Table 1, forest cover ratio at the time of ex-post evaluation in 2011 was 12.4% (101,533 ha) and vegetation cover ratio was 70%; both figures achieved the targets. Of the 12.4% of forest cover ratio, 1.4% was accomplished by Chinese national tree planting project.

**Table 1 Forest cover ratio / Vegetation cover ratio**

Indicators	Baseline (2001)	Target (2009)	Baseline (2009)	Target (2011)
Forest cover ratio in the project sites	6.9%	10%	11.4%	12.4%
Vegetation cover ratio in the fenced grasslands	30%	70%	70%	70%

Source: Appraisal document, Ningxia Agricultural Comprehensive Development Office (ACD)

##### (2) Other Indicators

As shown in Table 2, survival rates of both protective sand fixation forest and economic forest have achieved the targets. These target figures of survival rates are defined in “Checking regulation in project for conversion of cropland to forest.”

**Table 2 Survival Rates of Planted Protective Sand Fixation Forest and Economic Forest (Average of 12 Counties/ Cities)**

	Target (2001)		Achievement (2004-2010)	
	1 <sup>st</sup> Year	3 <sup>rd</sup> Year	1 <sup>st</sup> Year	3 <sup>rd</sup> Year
Survival rate of protective sand fixation forest	More than 70%	65%	85%	70%
Survival rate of economic forest	More than 85%	85%	85%	85%

Source: Appraisal document, ACD

The vegetation cover ratios of grassland and medicinal-herb gardens have both achieved the target figure of 90% after 3 years of plantation. Although some planted seedlings had withered to death in several target districts due to extremely cold weather in 2004, supplemental planting was carried out to compensate for 100% of the dead seedlings in protective sand fixation forest. With respect to the expenditure for supplemental planting, local governments paid for the seedlings planted in public places while farmers paid for those planted around their farmland.

<sup>3</sup> Sub-rating for Effectiveness is to be put with consideration of Impacts



Protective sand fixation forest (Zhongwei)



Protective sand fixation forest around farms and lateral canal (Lingwu)

### 3.2.2 Qualitative Effects

In this project, beneficiary survey was conducted for a total of 100 residents in 4 target districts, namely, Yinchuan, Wuzhong, Zhongwei, and Lingwu. In the survey result, 94% of the farmers replied that “vegetation cover and forests in the region have increased.” This confirms that increase in the rate of forest and vegetation cover has been recognized by the residents. In the project, planting activities were carried out in degraded lands, where there had originally been no vegetation, by developing irrigation facilities and farm roads. Construction of such infrastructure facilities enhanced efficiency in plantation and cultivation activities and in shipments of the produce from economic forest and medicinal herb gardens.

## 3.3 Impact

### 3.3.1 Intended Impacts

#### (1) Prevention of desertification by increased vegetation cover

This project has afforested the land area of 58,385 ha, which has contributed to the prevention of desertification exacerbation and yellow dust damages in the target areas. Vegetation cover has been increased in wastelands and bare grounds and active sand dunes have been fixed by the protective sand fixation forests. In the beneficiary survey result, 97% of the respondents replied positively to the question, “Desertification has been alleviated / greatly alleviated.” Reduction of dust storm and floating dust has also been reported as follows. The contributing effects of this project on preventing desertification are recognized by residents.

- Desertification has been alleviated / greatly alleviated: 97%
- Dust storm has been reduced / greatly reduced: 96%
- Floating dust has been reduced / greatly reduced: 96%

(2) Improved standard of living of the poor in remote areas

Population living in poverty in Ningxia was 904,500 in 2001 (16.11% of the total population) and 168,000 in 2009 (2.72% of the total population). Chinese government revised the definition of poverty at the end of 2008 from annual per capita income of 1,067 RMB to 1,196 RMB.

In this project, irrigation facilities and farm roads were developed in the degraded lands where there had originally been no vegetation. In these areas, farmers planted cash crops such as wolfberry, alfalfa, licorice, jujube, and fruits by expanding farmland, which brought farmers additional sources of income. In carrying out the planting activities, large-scale farmers and grazers employed workers, and this created employment opportunities in the region. Both unit yield and unit production value of the above mentioned cash crops, with the influence of commodity price increase, have increased in 12 counties/cities as shown in Table 3.

**Table 3 Unit Yield and Income Increase of Major Crops in 12 Counties/ Cities**

	Before the project (2001)			After the project (2011)			Increment (%)
	Yield (tons/ha)	Unit price (RMB)	Income per 1ha (RMB)	Yield (tons/ha)	Unit price (RMB)	Income per 1ha (RMB)	
Wolfberry	2.4	16,000	38,400	2.8	28,000	78,400	204%
Alfalfa	18.6	1,100	20,460	19.5	1,500	29,250	143%
Licorice	15.4	28,000	431,200	15.7	35,000	549,500	127%
Jujube	9.5	8,600	81,700	15	12,000	180,000	220%
Fruits	8.4	2,400	20,160	10.8	3,600	38,880	193%

Source: ACD, Interview



Farmers to ship the red jujube (Yinchuan)



Licorice that is harvested in the medicinal herb garden (Lingwu)

In the result of the beneficiary survey, 73% of the respondents replied that their cash income has increased by the additional revenue from their economic forest and medicinal plants. The rest of the respondents mentioned that their crops have not yet generated income because some varieties take a long time until harvest. Plantation of economic



forests was completed in 2007, and some of the planted fruit trees require a minimum of three to five years to fruition such as apples and almonds. About the productivity of farmland, 86% of the respondents answered that it has improved, and 96% replied that the economy of the region has been activated by this project. This project has contributed to improve the livelihood of the local farmers to a certain extent.

### 3.3.2 Other Positive/Negative Impacts

#### (1) Cooperation with a local government in Japan

Ningxia has been promoting formal and informal exchanges with Shimane Prefecture since 1993. On July 30, 1997, Ningxia and Shimane signed a friendship agreement on forest reclamation and they carried out planting of 15ha in Lingwu between 1998 and 2001. Tree-planting activities have been continuously funded by both Ningxia and Shimane since then, and 400 thousand trees have been planted in the 50 ha of land to date.

#### (2) Participation and burdens of farmers

The number of beneficiaries of this project has reached to 63,120 households for the target of 59,372 households. The number of farmers mobilized for providing labor went up to 49,640 people for the target of 35,800 people. Both figures well exceeded the targets. According to the beneficiary survey, 76% of the residents who contributed their labor to the activities such as plantation of protective sand fixation forests or construction of main canals answered that the workload was heavy (heavy 36%, very heavy 40%). However, their actual engagement with such activities was equal or less than 4 man-days per Mu<sup>4</sup>, which was sufficiently below the national regulations of 10 man-days per Mu in 2008. In addition, to avoid overburdening the farmers with labor contribution in protective sand fixation forest plantation activities, recommended ratios of the planting items were specified as follows: “protective sand fixation forest should be around 1.7 mu (14%), red jujube should be around 2.5 mu (21%), wolfberry should be around 5.0 mu (42%), and grassland should be around 2.8 mu (23%).” The participated farmers were monitored not to deviate greatly from these ratios and labor contribution was maintained well within the recommended ratio in actual implementation.

In this project, the local governments had made advance payments for seedlings and materials for participated farmers and asked them for repayment once they start to generate revenues from the fruit trees and medicinal plants. Loans were made available only to the farmers who had ability to repay. In some cases, large-scale farmers or village committee chiefs became borrowers on behalf of small-scale farmers. Although repayment terms are

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<sup>4</sup> Mu is an area unit and 1 Mu = 0.067 ha.

in accordance with the conditions of ODA loans, arrangements and scheduling are made flexible (0.75% to 0.9% interest rate, repayment period of 15 years to 40 years). According to ACD, there have been no interest payments arrears. In the beneficiary survey, 80% of the residents have responded that the burden of repayment has not been excessive. In Yinchuan and part of Wuzhong, local governments paid subsidies or seedling costs to encourage farmers to switch from wheat and cotton production to economic forest, in accordance with the policy for conversion of degraded farm land into forest.

### (3) Impacts on the natural and social environment

At the time of appraisal, there were concerned environmental impacts as follows: possible negative environmental impacts from the use of pesticides and insecticides, soil salinization from over-extraction of groundwater, possible negative impacts from construction activities and from the changes in land use. However, no major problem has been observed as the government strictly controlled these issues by prohibiting the use of chlorine-based pesticides or by imposing permits for groundwater pumping. Construction impacts on the environment were also strictly monitored. As for the land use change, increase in vegetation cover on the degraded land should actually be considered as positive impacts on the local environment. In the beneficiary survey, 90% of respondents answered that wind erosion and soil erosion have been reduced.

### (4) Other Impacts

This project was reported in China's national newspaper such as "People's Daily" and local newspapers in Ningxia, and in other media as a sandstorm prevention project. It was also published in 23 scientific journals. The success of the project was highly acclaimed by the Chinese government. ACD held a nationwide meeting in Ningxia in 2006 to exchange experiences about desertification prevention. Ningxia is increasing awareness as a model area for desertification prevention.

During this project, technology that had been transferred in the "Ningxia Forest Protection Research Program (April, 1994 –March, 2001)," such as controlling long-horned beetles, was widely used.

From the above, this project has largely achieved its objectives; therefore its effectiveness is high.

## **3.4 Efficiency (Rating: ③)**

### 3.4.1 Project Outputs

Within the 12 counties/cities in the northern part of Ningxia Hui Autonomous Region, trees, shrubs and medicinal plants were planted and related facilities were established. The

outputs of this project were carried out mostly as planned as follows.

**Table 4 List of outputs**

	Target at the time of appraisal (2009 as Target Year)	Actual outputs at project completion (2009)
Afforestation and vegetation cover	57,600 ha	58,385 ha <sup>5</sup>
Fencing closure	26,090ha	26,090 ha
Protective sand fixation forest	12,550ha	13,200 ha
Economic forest	10,050ha	10,088 ha
Grassland formation	7,690ha	7,787 ha
Medicinal plant cultivation	1,220ha	1,220 ha
Seedling Center	1,100ha	1,122 ha
	Production Capacity	
	Arbor trees	70 million seedlings
	Shrubs	10-12 million seedlings
	Seeds	16,500kg
		Production Capacity
	Arbor trees	76.5 million seedlings
	Shrubs	10.98 million seedlings
	Seeds	16,680 kg
Model Area Construction	1,100ha (Note)	1,064 ha
Road Construction	Main Roads (40km), Branch Roads (80km), Farm Roads (200km)	320 km
Livestock Stable Construction	100,000 m <sup>2</sup>	103,080 m <sup>2</sup>
Irrigation Facilities	Branch Canal (120km), Lateral Canal (294km), Farm Canal (1,350km), Sprinklers (667ha) , Drip Irrigation Facilities (667ha)	Canal (1852 km), Sprinklers (903 ha), Drip Irrigation Facilities(880 ha)
Environmental Monitoring	Procurement of monitoring equipment	30 sets
Vehicles etc.	Procurement of Vehicles, Computers, and Office Construction etc.	40 Vehicles. Office Construction
Technical Extension and Trainings	Training on plantation of trees and shrubs for participating farmers and County forestry bureau's staff. Training centers: 1 center for technicians in Yinchuan and another center for farmers in Pingluo	2850 farmers have participated in the training.

Source: Appraisal document, ACD

(Note) Although the target figure of the district model had been stated as 1100 ha in the appraisal document, ACD had recorded and recognized it as 1064 ha, which ended up in this gap of 36 ha.

The protective sand fixation forest reached 13,200 ha and exceeded the original target by 650 ha because the farmers expanded the forest voluntarily around their farms for the

<sup>5</sup> As reference information, examples of forest planting interval are as follows: Locust to be used for forest protection 2mx3m, fruit trees 2mx4m, *Caragana Microphylla* 2mx8m, Medlar 1mx3m, alfalfa 10cmx35cm, herbs such as licorice 10cmx25cm, and the like.

purpose of sand and wind prevention. While city and county governments absorbed the expenses for plantation in public places, the plantations made around the farms for the purpose of wind/ sand breaks were born by the farmers. Sprinkler and drip irrigation area has been increased from the original plan since more facilities were identified necessary during the implementation of the project.



Grassland (Yinchuan)



Irrigation canal (Wuzhong)

### 3.4.2 Project Inputs

#### (1) Project Cost

The actual project cost was mostly as planned (99.8% of the plan). In Japanese yen, the total project cost was budgeted as 10,683 million yen at the time of appraisal, of which the finance portion of yen loan was 7,977 million yen, consisting of 159 million yen in foreign currency and 7,818 million yen in the local currency. The rest was to be covered by the Ningxia and local governments' budget and provision of labor by farmers. The total actual project cost was 10,665 million yen, of which yen loan was 7,977 million yen, consisting of 171 million yen in foreign currency and 7,806 million yen in the local currency. The rest was covered by the Ningxia government (1,143 million yen), city and county governments (900 million yen), and provision of labor by farmers which accounted for 645 million yen.

**Table 5 Actual project cost**

(Unit: Million Yen)

Items	Foreign currency		Local currency		Total	
	Total	JICA funded	Total	Total	JICA funded	Total
Afforestation and vegetation cover	0	0	5,949	5,295	5,949	5,295
Auxiliary Facilities Construction and Equipment	171	171	2,910	2,511	3,081	2,682
Administration, taxes, and Interest during Construction	0	0	1,635	0	1,635	0
<b>Total</b>	<b>171</b>	<b>171</b>	<b>10,494</b>	<b>7,806</b>	<b>10,665</b>	<b>7,977</b>

Source: Appraisal document, ACD

Exchange rate at the time of ex-post evaluation : 1 RMB = 14.3 Yen

(2) Project Period

Project period was mostly as planned. It was completed in 94 months from March 2002 (signed L/A) to December 2009 as planned. The definition of project completion is as follows.

- Afforestation and Vegetation Cover: In accordance with “Checking regulation in project for conversion of cropland to forest”, to pass the inspection within 3 years after planting
- Fencing closure: In accordance with “Checking regulation in project for conversion of cropland to forest”, to pass the inspection after 3 years of completion
- Infrastructure facilities and vehicles, etc.: Commissioning to the local agencies and governments

Details of the actual project period are shown in Table 6.

**Table 6 Actual project period**

	Project Period	
	Plantation Period	Inspection Approval (Definition of Approval)
Fencing Closure	March 2003 to December 2005	June, 2009 (At least 50% vegetation cover with more than 20% of shrubs 3 years after plantation)
Sand Fixation Forest	March 2003 to December 2007	June, 2009 (At least 70% survival 1 year after plantation. Those who did not pass the inspection after 1 year should conduct replantation to reach 70% within 3 years)
Economic Forest	March 2003 to December 2007	June, 2009 (At least 85% survival after 1 year. Those who did not pass the inspection after 1 year should conduct replantation to reach 85% within 3 years)
Grassland Formation	March 2003 to December 2006	December, 2009 (At least 80% grass cover after 3 years)
Medicinal Plants	March 2003 to December 2006	December, 2009 (At least 80% coverage after 3 years)
Road Construction	March 2003 to December 2006	
Irrigation Facility Construction	March 2003 to September 2008	
Contract with farmers	June 2003 to December 2007	
Procurement of materials	May 2003 to December 2007	
Technical training on plantation	March 2003 to June 2009	

Source: Appraisal document, ACD

The project started in March 2003, approximately one year later than planned. The postponement was due to delay in signing of L/A and entering into E/N, which was carried out at the end of March 2002 and missed the planting season in the same year. There was also a delay in planting activities of the protective forest and economic forest that had been

scheduled to be completed by the end of 2006. The delay was due to severe droughts and frosts which damaged young seedlings for which re-planting was made. Despite these delays, the plantations successfully passed the inspection within the planned period in accordance with the “Checking regulation in project for conversion of cropland to forest.”

#### 3.4.3 Internal Rates of Return (IRR)

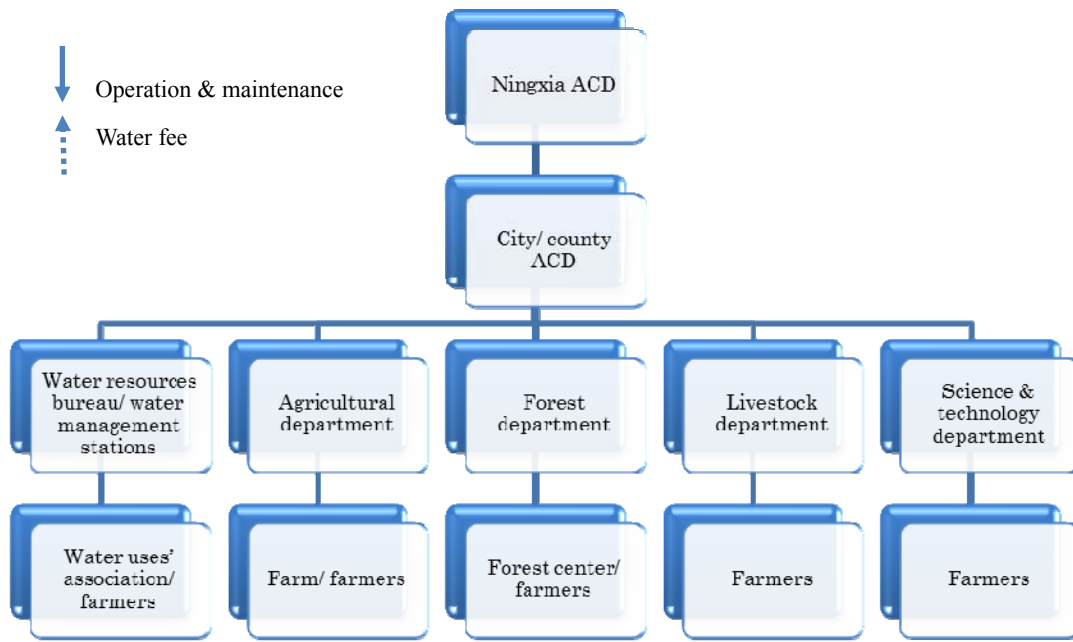
In this Project, only economic forests and medicinal plants can be monetized to see the direct effect on the income. Other components require long time for the effects to be seen. Thus, a quantitative analysis of the internal rate of return was not conducted.

Both project cost and project period were mostly as planned, therefore efficiency of the project is high.

### 3.5 Sustainability (Rating: ③)

#### 3.5.1 Structural Aspect of Operation and Maintenance

There is no change in the structure of operation and maintenance of the plantations and facilities constructed during the project from the original plan. The city and county governments implement the operation and maintenance of the roads, fencing closures, and protective sand fixation forests. Each farmer manages economic forests, grassland, herb gardens and the protective sand fixation forests around their farms. The model forests are managed with the cooperation of farmers and forestry bureau, while irrigation facilities are managed with the cooperation of water resources bureaus and water management associations. There are no particular problems arisen in the target areas since ACD offices have experienced similar projects in the past and have accumulated technical knowledge and know-how in the project management. Cultivation by each farmer has been actively carried out especially for economic forests, medicinal plants, and pasture, since cash income can be generated from these produce, which serves as an incentive.



Source: ACD

**Figure 2 Management Structure**

In this project, it was necessary to involve many actors such as the farmers and various offices of each of the 12 county/city governments (Forestry Bureaus, Agricultural Bureaus, Pastoral Bureaus, Water Management Bureaus, Science and Technology Bureaus) from the project implementation phase to maintenance, as shown in Figure 2. The reason for successful conduct of maintenance activities involving the various government agencies would be attributed to the ACD’s high management capacity to oversee these institutions both at autonomous region government and local government levels.

According to the beneficiary survey results, 77% of the residents carry out daily maintenance of the trees, shrubs, herbs, grass, etc. planted in the project; while 85% do the maintenance at least once a week. Maintenance of irrigation facilities has been conducted on a regular basis in March and October every year.

Possible reasons for high ownership of the farmers would be because they had been involved in the project from the beginning and designing stage of the project and because the farmers had paid (or loaned) for their own seedlings. In part of Wuzhong and Yinchuan, although the governments had borne the cost of seedlings pursuant to the government policy of conversion of degraded farm land into forest/grass, the farmers seem to have had enough motivation to take care of the plants because the economic forests became their means to earn living after the conversion.

### 3.5.2 Technical Aspects of Operation and Maintenance

In this Project, afforestation technology as well as nursing and management of seedlings follow the provisions such as “provision of afforestation technology,” a national standard, and “Ningxia technical provision of afforestation and sand treatment”, and “Ningxia grassland management ordinance.” As shown in Table 7, the number of staff and their technical level are adequate. Manuals for operation and maintenance have also been developed. As indicated in Table 8, various trainings were carried out during the implementation of the project. Even after the completion of the project, various trainings on planting, nursery, and management, etc. have been carried out by ACDs and local governments.

**Table 7 Operation and administrative work, the number of workers and technicians**

	Office/ entity/ individual in charge of O&M	Description of O&M work	Approx. number of O&M staff allocated
<b>Afforestation and Vegetation Cover</b>			
Fencing Closure	County Animal Husbandry Bureau	Fence repair, fair prevention, pest and disease control	260 (120)
Protective Sand Fixation Cover	County Forestry Bureau or Forestry Centre	Irrigation, fertilization, fire prevention, pest and disease control, pruning	860 (360)
Ecological Economic Forests	Project implementation farmers	Irrigation, fertilization, fire prevention, pest and disease control, pruning	2250 (426) (Note)
Grassland	Project implementation farmers	Irrigation, fertilization, fire prevention, pest and disease control, pruning	2010 (810) (Note)
Medicinal Herb Cultivation	Project implementation farmers	Irrigation, fertilization, fire prevention, pest and disease control	320 (196) (Note)
Seedlings & Seed Nurseries	Farm factory	Irrigation, fertilization, fire prevention, pest and disease control	128 (56) (Note)
Model Area Construction	Farm factory & Forestry Bureau	Irrigation, fertilization, fire prevention, pest and disease control, pruning	260 (145) (Note)
Road Construction	County Government	Revamping, flattening	240 (12)
Livestock Stable Construction	Farmers	Revamping	48 (6) (Note)
Irrigation Facilities Construction	Water Conservancy Bureau or	Revamping	360 (148)
Environmental Monitoring	Environmental Monitor Station	Maintenance of the facilities	18 (6)
Procured Vehicles, Computers, and Constructed Office	District and Country Project Office	Maintenance of the facilities	16 (16)

Source: ACD

(Note): Number of technicians in ( ) refers to dedicated technicians in case of a farm; and extension workers of local government’s forestry office.



Manuals have been formulated by Ningxia Forestry Bureau, local governments and in forestry centers as follows.

- Forestry Project Management Approach, 2002, Lvfeng Forestry Farm in Zhongwei City
- Water Supply and Electricity Management System, 2002, Lufeng Forestry Farm in Zhongwei City
- Lufeng Forestry Farm Safety Management System, 2002, Lufeng Forestry Farm in Zhongwei City
- Forest Production Management System, 2002, Qingtongxia Forestry Bureau
- Wells Operation and Management Approach, 2002, Shizuishan Ecological Forestry Farm
- West Mountain Shelter Forest Management Approach, 2002, Shizuishan Bureau of Parks and Woods
- Yinchuan City Western Shelter Forest Management Approach, 2003, Yinchuan Western Shelter Forest Management Office
- Returning Farmland to Forest and Grassland Management Approach, 2002, Ningxia Forestry Department

**Table 8 List of trainings conducted during project implementation**

Organization of trainees	Name of training provider	Training subject	Year/Hours	Total No. of trainees
Autonomous Region Project Office	Ningxia University, Ningxia Academy of Agriculture, Beijing Chinese Medicine University, Nanjing Forestry University	Project management	2002/24	36
		Financial Management	2002/16	18
		Planting techniques of medicinal herbs	2003/12	45
		Comprehensive ecological control techniques	2005/16	34
Cities and counties Project Management Office	Ningxia University, County Agricultural Technology Promotion Center, County Agriculture Bureau, County Conservancy Bureau	Demonstration of sand treatment technology	2003/16	126
		Construction of hydraulic engineering	2003/8	108
		Seeding breeding technology	2003/16	56
		Water-saving irrigation techniques	2004/8	146
		Planting and land preparation techniques	2004/16	246
		Medicinal herb planting techniques	2004/12	128
		Jujube planting techniques		
		Grape planting techniques	2004/6	320
		Cultivation technology of red jujube	2004/6	360
		Cultivation technology of wolfberry	2004/8	128
Pest control techniques	2005/8	246		

Source: ACD

### 3.5.3 Financial Aspects of Operation and Maintenance

Each county/city government bears the management cost of the protective sand fixation forests, roads, and main canals, which were established in public places. Individual farmers pay for the maintenance and management cost of economic forests, medicinal plants, and peripheral irrigation facilities. Budget of the forestry sector, operating and administrative expenses, and water fee collection revenue of 12 counties/cities in total are shown in Table 9 and 10. Both the sector budget and operating/administrative expenses have been increasing over the past five years.

**Table 9 Budget of the forestry sector, operating/administrative expenses, and irrigation fee revenue of 12 counties/cities in total**

(unit: million RMB)

	2007	2008	2009	2010	2011
Forestry sector budget	27,600	32,010	35,220	40,850	44,120
Allocation for Operation and Maintenance total	11,040	12,804	13,380	15,520	15,440
Revenue from water collection fees	6,950	6,490	6,980	7,100	6,990

Source: ACD

**Table 10 Irrigation fee**

(Unit: RMB/m<sup>3</sup>)

	2006	2007	2008	2009	2010
Water fees	0.0195	0.0195	0.0195	0.0195	0.0195
Collection rates	98%	99%	98%	97%	98%

Source: Questionnaire responses

Note: No data available in 2011

Each county/city government spends the cost of operation and maintenance for irrigation facilities that are not covered by irrigation fee. Management of peripheral irrigation facilities can be sufficiently covered by irrigation fees. Main canal operation or large scale repair projects, on the other hand, need to be compensated and are fulfilled by the budgets of Ningxia government such as “small field irrigation basic construction expenditure” or by the budget of local governments. According to the beneficiary survey results, 96% of the residents answer that irrigation fee is reasonable.

In Zhongwei, Meili Papermaking CO. Ltd, a semi state-owned paper company, purchases the thinned trees from Lufeng Forestry Center (6,670ha), one of the project sites and provides financial resources of maintenance and management of the forest in the center.

### 3.5.4 Current Status of Operation and Maintenance

Operational status of established facilities is generally good. During the site visits, forests, irrigation facilities, model areas, fencing closures, and protective sand fixation

forests were managed and maintained properly.

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**

Situated in the Yellow River basin of Northwestern China, Ningxia Hui Autonomous Region, hereinafter referred to as Ningxia, is one of the areas with the severest precipitation scarcity throughout China. Controlling desertification by increasing forest and vegetation cover had been an urgent task for environmental protection of Ningxia. Poverty ratio in Ningxia had been higher than in the entire China, thus, there was a substantial need for assistance in poverty alleviation through plantation activities by the local farmers. This project was highly consistent with China's national development programs, local development needs as well as Japanese ODA policy; therefore relevancy of this project is high. The project has largely achieved its objective of increasing forest cover ratio and fenced grasslands' vegetation cover ratio; therefore its effectiveness is high. The planted economic forests and medicinal herbs have contributed to increase the income of the farmers; therefore its impact is high. Both project cost and project period were mostly as planned, therefore efficiency of the project is high.

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

### **4.2 Recommendations**

#### 4.2.1 Recommendations to the Executing Agency

There is no recommendation to the Executing Agency.

#### 4.2.2 Recommendations to JICA

There is no recommendation to JICA.

### **4.3 Lessons Learned**

There are several reasons for the success of this large-scale afforestation project in the region with such scarce precipitation. First of all, the project not only involved plantation of forests and grass, but also integrated infrastructures such as roads and irrigation facilities to augment the efficiency of the plantation and nursing activities. Secondly, high coordination and management capability of the ACD enabled the local government offices in 12 counties/ cities and farmers to collaborate efficiently. Thirdly, in technical aspect, the project was able to utilize advanced technology obtained during the preceding technical cooperation project "Ningxia Forest Protection Research Plan (April, 1994 – March, 2001)". Fourthly, farmers' involvement from

the early stages of the project enhanced their participation; and the project design that encouraged the farmers to pay (loan) for their own seedlings gave them the incentive to take care of the plants. Economic forests, medicinal plants, and pasture grass gave them increased opportunities of income generation. And this serves as the incentive for the farmers to contribute their labor in planting and maintaining the protective sand fixation forests established around their farms in order to protect their plants. For the activities that are more of a public nature such as plantation of protective sand fixation forests in public places and water canal construction, farmers were compensated with allowance, which also provided economic incentives for poor farmers to participate in the Project.

### Comparison of the original and actual scope of the Project

Items	Original	Actual
1. Project Outputs	<p>&lt;Afforestation and vegetation cover Total&gt; 57,600 ha</p> <p>Fencing closure: 26,090ha</p> <p>Protective sand fixation forest: 12,550ha</p> <p>Economic forest: 10,050ha</p> <p>Grassland: 7,690ha</p> <p>Medicinal plants: 1,220ha</p> <p>&lt;Seedling center&gt; 1,100ha</p> <p>&lt;Model Area&gt; 1,100ha</p> <p>&lt;Road construction&gt; Main road (40km), Branch roads (80km), Farm roads (200km)</p> <p>&lt;Livestock stable&gt; 100,000 m<sup>2</sup></p> <p>&lt;Irrigation Facilities &gt; Branch Canal (120km), Lateral Canal (294km), Farm Canal (1,350km), Sprinklers (667ha), Drip Irrigation Facilities (667ha)</p> <p>&lt;Environmental Monitoring &gt; Procurement of monitoring equipment</p> <p>&lt;Vehicles etc.&gt; Procurement of Vehicles, Computers, and Office Construction etc.</p> <p>&lt;Technical Extension and Trainings&gt; Training on plantation of trees and shrubs for participating farmers and County forestry bureau's staff. Training centers.</p>	<p>Mostly as planned.</p> <p>&lt;Afforestation and vegetation cover Total&gt; 58,385 ha</p> <p>Fencing closure: 26,090 ha</p> <p>Protective sand fixation forest: 13,200 ha</p> <p>Economic forest: 10,088 ha</p> <p>Grassland: 7,787 ha</p> <p>Medicinal plants: 1,220 ha</p> <p>&lt;Seedling center&gt; 1,122 ha</p> <p>&lt;Model Area&gt; 1,064 ha</p> <p>&lt;Road construction&gt; 320 km</p> <p>&lt;Livestock stable&gt; 103,080 m<sup>2</sup></p> <p>&lt;Irrigation Facilities &gt; Canal (1852 km), Sprinklers (903 ha), Drip Irrigation Facilities (880 ha)</p> <p>&lt;Environmental Monitoring &gt; 30 sets of monitoring equipment</p> <p>&lt;Vehicles etc.&gt; Vehicles 40. Office Construction</p> <p>&lt;Technical Extension and Trainings&gt; 2850 farmers have participated in the training.</p>
2. Project Period	March, 2002 –December, 2009 (94 Months)	March, 2002 –December, 2009 (94 Months)
3. Project cost		
Amount paid in Foreign currency	159 Million Yen	171 Million Yen
Amount paid in Local Currency	10,524 Million Yen (701.6 Million RMB)	10,494 Million Yen (733.8 Million RMB)
Total	10,683 Million Yen	10,665 Million Yen
Japanese Yen loan portion	7,977 Million Yen	7,977 Million Yen
Exchange rate	1RMB=15Yen (as of September 2001)	1RMB=14.3Yen (average between March 2002 and July 2007)