



(Research Institute of Forest Ecology,
Environment and Protection, China Academy of Forestry)

EIB (European Investment Bank)

CDM AFFORESTATION PROJECT

IMAR (Inner Mongolia Autonomous Region)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT



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Afforestation Project

Commission Unit: Inner Mongolia Forestry Administration, PRC (IMFA)

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List of Abbreviations and Acronyms

ADB	Asian Development Bank
ARPMO	Autonomous Regional Project Management Office
CAF	Chinese Academy of Forestry
CDM AP	Clean Development Mechanism Afforestation Project
CNEIB	Context Note of European Investment Bank
CSA	Carbon Sequestration Afforestation
EFI	Environmental Field Inspector
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EIBPCO	European Investment Bank Project Coordinating Office
EMS	Environmental Monitoring Station
EPB	Environmental Protection Bureau
ESD	Environmental and Social Department (of PMOs)
ESIA	Environmental and Social Impact Assessment
ESMaP	Environmental and Social Management Plan
ESMoP	Environmental and Social Monitoring plan
ESMMP	Environmental and Social Management and Monitoring plan
ESPH	Environmental and Social Practices Handbook
FMPA	Forestry Monitoring and Planning Academy of IMAR
FSDA	Forestry Survey and Design Academy of IMAR
IMAR	Inner Mongolia Autonomous Region
IMEPB	Inner Mongolia Environmental Protection Bureau, PRC
IMFA	Inner Mongolia Forestry Administration, PRC
IMPG	Inner Mongolia People's Government, PRC
MEP	Ministry of Environmental Protection, PRC (Original NEPA)
NDRC	National Development and Reform Commission
NEPA	National Environmental Protection Agency

NPC	National People's Congress
OIPM	Organizations of Plantation Integrated Pest Management
PEO	Project Executive Office
PIPM	Plantation Integrated Pest Management
PIU	Project Implementation Unit
PLG	Project Leading Group
PMO	Project Management Office
PRC	People's Republic of China
RIFEEP	Research Institute of Forest Ecology, Environment and Protection, CAF
SFA	State Forestry Administration, PRC
SIA	Social Impact Assessment
SFI	Social Field Inspector
SS	Suspended Solids
TOR	Terms of Reference (TOR) of the Environmental and Social Impact Assessment, EIB
TSP	Total Suspended Particles
WB	World Bank
WBLM	World Bank Loan Management Centre of SFA, PRC
CURRENCIES	
Y	Chinese Yuan (RMB)
EURO	Eurodollar
Conversion rate	1 EURO = 10.6 Y

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Annex C: Environmental Protection Guidelines for Plantation Establishment and Management.

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Executive Summary

1. Origin of the Report

Considering the harm caused by climate change to human beings, and the responsibility of a conscientious country, Chinese government has already started the relative capacity construction of climate change to meet the challenge of it, and issued the “*Chinese National Climate Change Program*” in 2007.

In July, 2007, the board of directors of European Investment Bank (EIB) approved the Chinese Climate Change Framework Loans, and then EIB signed the loan agreement with China in November, 2007, providing 500 million Euro loan for China to meet the problems caused by climate change. After that, the planning of loan utilization was made by National Development and Reform Commission (NDRC), and approved by the State Council. According to the documents, the State Forestry Administration (SFA) selected Inner Mongolia Autonomous Region (IMAR) as the experimental site to carry out carbon sequestration afforestation with EIB loan, and approved the EIB Financed Clean Development Mechanism (CDM) afforestation project prepared by the Inner Mongolia Forestry Administration (IMFA).

Environmental and Social Impact Assessment (ESIA) is considered as an indispensable step of the project. Research Institute of Forest Ecology, Environment and Protection, China Academy of Forestry (RIFEEP) is responsible for the compiling work of ESIA report commissioned by IMFA. The ESIA report is to meet: requirements of environmental impact assessment (EIA) of construction projects in China and EIB, and “*Feasibility Study Report on European Investment Bank Loan CDM Afforestation Project*” proposed by Forestry Survey and Design Academy of IMAR (FSDA), and to follow the relevant laws and regulations of China. In the course of ESIA, an ESIA team was organized to carry out the environmental and social impact of the project and finally finish the ESIA report.

2. Project Description

This project will be organized by IMFA, and the construction units mainly include local governments of banners, counties, and/or districts, where the afforestations are located in, except Forestry Bureau which is the construction unit in Bayannao'er City. The total afforestation area of the project is 31805.7 ha. The project sites are located in Hohhot City (Xincheng District, Saihan District, and Helin County), Baotou City (Guyang County), Tongliao City (Kerqin District, Kezuohou Banner, Kezuozhong Banner, and Zhalute Banner), and Bayannao'er City (Desert Control Comprehensive Test Station). All the afforestation area is wasteland without forest. Several mixed afforestation modes are adopted in this project, such as rows mixed mode, strips mode, and small patches mode. Approximately 239.9 km of forest road will be built, and there would be technical training of 14444 person-times with different levels and expert consultation of 90 person-times.

The construction duration of the project will last 5 years, and the total investment is 378.628 million Y. After the end of the project, the total economic benefit will reach 1618.694 million Y (including 419.86 million Y of carbon sequestration), and the new afforestation is estimated to effectively protect the farmland and pasture of 159000 ha from soil erosion and desertification.

3. Stakeholder Consultation

The consultation methods adopted in this project include placarded walls in the project areas, information open online, distribution questionnaires, holding consulting conferences, interviewing the local forestry and environmental protection administration departments, public seminars and individual consultations. The results show that the project will be favorable to the project area and individuals, and expected to be carried out as soon as possible.

4. Analyses of Environmental Impact

According to extent and scope of environmental impact to be caused by the project, the environment factors are screened in the ESIA report firstly, through the analyses

of impacts on ecological environment, physical environment and environmental risk caused by selection of afforestation sites, afforestation patterns and tree species, site preparation, insemination, plantation tending, and forest road construction in implementation phase and operation phase. And relevant mitigation measures are proposed then. The analyses result shows that site preparation and forest road construction would bring in soil erosion in certain extent. After the completion of the project, the vegetation coverage rate would increase and remarkable ecological benefit would come into being. While ecological barrier would be formed, the capacity of shelter and immobility of sand soil would be increased, soil erosion could be reduced, the climate would be regulated, and the ecological environment would be improved. The adverse impact caused by human activities during implementation phase and operation phase is short-lived, and will disappear when the project end up. If the proposed mitigation measures are implemented, the adverse impacts will reduce to receivable level.

5. Analyses of Social Impact

The analyses of social impact focused on local related stakeholder (including stakeholder of all levels), the right transfers of forest land, resettlement of residents caused by physical and economic interest, selection of afforestation sites and farmers participation in the project, safety and health of seasonal workers and permanent workers, vulnerable groups (including poor communities, women and minorities), and social risk and impact after the project implementation. The result shows that the project provides a great deal of employment opportunities to the residents, especially to the vulnerable groups, which will increase their incomes. And it is favorable for economic development in project area. The afforestation sites are all country or collective owned, so that the issue of right transfers of forest land utilization will not exist in this project. There is no residential land, farmland and pasture occupied by the project, so it will not involve the issue of resettlement caused by physical and economic interest. The seasonal workers and permanent workers are employed from the villages nearby the project area, so no new problems of social security and safety

caused by recruiting endemic workers will come into being. The economic benefit will increase remarkably by implementation of the project, while the living standard of the local residents will be enhanced.

If pesticides and fertilizers are improperly used, the health of forest workers and residents nearby will be threatened during the project implementation. It remains as problem that the employed workers possibly could not obtain the wage timely. The mitigation measures are proposed in allusion to adverse impacts one by one in the report.

6. Analyses of Alternatives

The comparison of impacts on environment of project and no-project is analyzed in the report. The result shows that relative to no-project, the project will be favorable to improve ecological environment. At the same time, it can provide a great deal of employment opportunities to the farmers in the project area, and then increase their incomes. Hence, the local economic revenue will increase through the project implementation, while the local economic configuration will be improved. It can be concluded that the project is recommended through integrative assessment. Then the feasibility of the project is demonstrated by analyses of selection of afforestation sites, afforestation patterns and tree species, policies, techniques, infrastructures, and requirements of carbon sequestration.

7. Monitoring and Management Plan

In order to ensure that environmental mitigation measures proposed in ESIA report will be implemented effectively, to prevent and reduce the adverse environmental and social impacts, and to fully **play** the benefits of all aspects of the project, an environmental and social management plan is formulated in this report, in which the implementer institutions and their responsibilities of project management and monitoring, monitoring items, training plans and budgets are included. Besides, the “*Environmental Protection Guidelines for Plantation Establishment & Management*”

and the “*Plantation Integrated Pest Management Plan*” are compiled separately.

8. Conclusions

The project is consistent with policies of meeting climate change, ecological construction and forestry industrial development of Chinese government. It accords with the requirement of local peoples’ economic and social development and relevant planning such as that of land use. Ecological, social and economic benefits have been all given attention to in this project. The plantations that will be constructed hold vast capacity of assimilating and fixing CO₂, and the farmers’ income will be increased in the project area. Meanwhile, the development of local economic will be promoted, the ecological environment will be improved, and then it will bring in harmoniousness of human and nature. After the mitigation measures are adopted, the adverse impacts on environment and society will be minimized. Therefore, this project is feasible from the point of environmental and social impact.

1 Introduction

1.1 Purpose of the ESIA

Climate change is a major global issue of common concern to the international community. That “we will enhance our capacity to respond to climate change and endeavor to protect the global climate” was included in the report of the 17th National Congress of the Communist Party of China, and then “*Chinese National Climate Change Program*” was issued in 2007 by National Development and Reform Commission (NDRC) of China. In July, 2007, the board of directors of European Investment Bank (EIB) approved “Chinese Climate Change Framework loans”, and then EIB signed the loan agreement with China, providing €500 million loan to support China to tackle the climate change in November, 2007. After that, NDRC compiled the Program of Loan, which was approved by the State Council. To achieve further effect of the forestry in tackling global climate change, the State Forestry Administration of China (SFAC) actively explored carbon sequestration and biomass energy afforestation with the foreign capital. IMAR was chosen by SFAC as experimental pilot to carry out the carbon sequestration afforestation with EIB loan based on “Circular on Printing and Distribution of the Project by Using the European Investment Bank loan to tackle Chinese Climate Change by State Development and Reform Commission (SFAC Decree No. [2007] 2503)”, and the program of Clean Development Mechanism (CDM) afforestation with the EIB loan put forward by the Forestry Department of IMAR (FDIM) was also approved. The selected pilot is a transitional zone between grassland and farming land in the middle and west of Inner Mongolia, which is one of the most seriously desertification regions in China, and also is the ecological region that should be mostly focused on.

Inner Mongolia Institute of Forestry Reconnaissance and Designing (IMIFR) had completed the “*Feasibility Study Report on the Project of CDM Afforestation by the Loan from European Investment Bank*”, and RIFEEP (Research Institute of Forest Ecology, Environment and Protection, China Academy of Forestry) is responsible for

the compiling of Environmental and Social Impact Assessment (ESIA) report commissioned by FDIM.

Based on requirements of construction projects in China on environmental impact assessment (EIA) and issues concerned by EIB, and three targets will be finished in this ESIA as follow:

(1) Analyze and evaluate the physical environment, ecological environment and socio-economic conditions of the project regions, determine the impact of the afforestation project on the scope and extend in the future, and investigate and verify the implementation of the environmental protection in this project.

(2) Analyze the potential environmental and social impact of the afforestation project, and feed the relevant information back to the supervision and implementation organizations of the afforestation project.

(3) Propose measures to reduce the adverse impact of this afforestation project on the basis of the Analyses of the potential environmental and social impact. Establish a management and monitoring plan including the implementation and operation period, including “*Environmental Protection Guidelines for Plantation Establishment and Management*” and “*Plantation Integrated Pest Management Plan*”, and submitting the conclusion and suggestion of Environmental and Social Impact Assessment (ESIA) to EIB, the supervision and implementation organizations of the afforestation project.

The purpose of the ESIA is to ensure that the project has no significant adverse impact on the physical, ecological, and social environment of IMAR. The project is to help to improve the ecological environment, explore technical methods on greenhouse gas control in China, increase farmers’ income, and realize simultaneous development of economy, society, and ecological environment in the project region.

1.2 Relationship to Feasibility Study

In order to do the EIA management for International Financial Organizations (IFO) lending construction projects well, to utilize the IFO funds better, and to promote

environmentally sound economic development, the National Environmental Protection Agency (NEPA) promulgated “*Circular on Strengthening EIA Management in Construction Projects Financed by International Financial Organizations (NEPA, No. [1993]324)*”, and proposed the requirements to the EIA of foreign fund financed project in 1993. According to the circular, IFO lending construction projects should be subject to environmental protection laws, regulations and standards in China and be subject to EIA system in China. At the same time, IFO technical requirements of EIA should be given attention under the premise of implementation of relevant regulation of EIA in China.

According to articles 9 and 17 of the “*Regulations on the Management of Environmental Protection in Construction Projects (State Council Decree No. 253 of 1998)*”, a construction unit should, at the feasibility study stage of the construction project, submit the Environmental Impact Assessment report to environmental protection department which possesses the right to examine and approve to seek their approval.

EIB has definite environmental protection requirements for their lending construction projects and the submission of ESIA reports is one of the necessary procedures to apply for their lending. Part documents issued by EIB describe the ESIA requirements and its review procedures, which are basically consistent with the EIA requirements and review procedures in China.

According to the handbook and the Terms of Reference (TOR) of the ESIA issued by EIB, the ESIA report mainly included the environmental and social assessment, especially the social impact assessment.

This project is carbon sequestration afforestation, which is a commonweal project to slow down the climate change. Its prime goal is ecological benefit, and to offer income to peasants and herders at the same time. There is no land occupied with primitive forest, valuable grassland or scrublands, and no long term construction activities in this project, so the adverse environmental impacts is limited, and can be mitigated by using

advanced technologies and proven mitigation measures. Based on suggestions and requirements of local government departments at all levels and the supervision organizations of the project, referring to the IFO suggestions and experience of the similar projects, the project was assigned to category B following “*Circular on Strengthening EIA Management in Construction Projects Financed by International Financial Organizations (NEPA, No. [1993]324)*”. That is to say: Construction projects have limited adverse environmental impacts in scope and severity. The adverse environmental impacts can be mitigated by using advanced technologies and proven mitigation measures. A full-scale EIA is not required for the project of category B, but special Analyse of environmental impact according to the features of project and environment is required.

The ESIA come into being based on the close cooperation of the project management office (PMO) of FDIM, members of the Feasibility study on the CDM afforestation, members of the ESIA, experts of the ESIA and the implement organization, and some mitigation measures have been proposed. In order to make sure that the public accept the project fully, we consult the local community, farmers, herdsman and forest growers extensively, and communicate with experts and the stakeholder of the project by the telephone, Internet, interviews, seminars and field survey during the assessment.

This ESIA report is completed at the project’s preparation stage as one part of the feasibility study. The feasibility study report includes some environmental problems discussed in the ESIA report, and the funds for the environmental and social management and monitoring include in the investment budget of the project.

1.3 ESIA Methodology

1.3.1 Methodology of ESIA

According to EIB requirements, we prepared different methodologies for the five stages work in the ESIA consulted the relevant provisions of World Bank (WB) and Asian Development Bank (ADB), and the Technical Guidelines for Environmental

Impact Assessment of China (TGEIA) as follow:

(1) Collection of basic data: collect the second-hand materials and data from the appropriate government department, gathering information on official websites, and getting the information by consulting books, chorography, and almanac and so on. The other task is carrying out the field survey by spot check.

(2) Public consultation: Task of this stage progressed with the forms of information issuance via the Internet, posting notices, distribution the public questionnaire, holding the forum and interviews, and at last analyzing the suggestions and requirements with the statistical analyses.

(3) EIA: EIA is based on the Technical Guidelines for Environmental Impact Assessment of China. Primary impact of this project is impact of ecological. It is evaluated by analogy analyses, expert consultation and empirical model prediction, and some mitigation measures are proposed then.

(4) SIA: Referring to the technical guidelines for SIA of WB and ADB, and combining EIB requirements, data are collected by consulting technical information, field survey, government departments archive survey and internet to complete the social assessment, following the suggests from the stakeholders of the project and experts.

(5) Management and monitoring plan: Based on the characteristics of the CDM afforestation project, this work progressed by collecting monitor data, referring management experience of other projects and consulting experts.

1.3.2 Schedule of ESIA

The schedule of ESIA was set as follow:

(1) Prepare work outline for Environmental and Social Impact Assessment, August 13-14, 2008.

(2) Analyze available documentation, regional distribution of the project and physical and ecological environment conditions of the project region and legislation framework; collect and investigate the basic data for the social assessment (including population,

society and economy, health and safety, public consultation and minorities problems), August 15-21, 2008.

(3) Carry out field survey (including public consultation and public testimonial session), August 20-22, 2008.

(4) Prepare environmental and social impact Analyses and prediction, and make measures for reducing the environmental impact, August 22-23, 2008,

(5) Organize experts to discuss the possible environmental and social issues, and other issues of particular concern, such as minorities' problems, August 24-26, 2008 (including the preparation of the conference).

(6) Summarize the Chinese version of the report, and then revise the report according to suggestions of the experts, August 27-31, 2008.

(7) Translate the report into English, and then submit the draft of the report, September 1-10, 2008.

(8) Revise the English version of the report in accordance with the opinions of the Central Project Office, EIB, and project sponsor, and submit the final report, September 10-October15, 2008.

1.3.3 ESIA Consulting Team

Correlative experts and members of RIFEEP were in charge of the report of ESIA, and IMIFR assisted the work.

The team included of the following members:

Project Director and Coordinator: Fu Yaping

Members: Li Yu, Li Xingchun, Zhang Yongan

Other Staff: Ma Zuoli, Wang Jiangling, Xin Jing, Du Xianyuan, Gao Qian, Liu Jianlin, Wang Lili, Bai Liping, Chen Jie, and Lv Xin

Experts:

Professor Li Yu (Environmental Impact Assessment)

Professor Li Xingchun (Hydrology and Water Resources)

Professor Xiao Wenfa (Forest Ecological)

Professor Guo Quanshui (Global Climate Change)

Professor Zhang Yongan (Integrated Pest Management)

Senior Engineer Chen Jie (Forestry Planning)

Senior Engineer Lv Xin (Natural Resource Management)

Associate professor Zhao Wenjin and Senior Engineer Zhao Xuejun (Sociology)

2 Policy, Legislation and Administration Framework

2.1 Project Organizations and Administrative Framework

2.1.1 Organization Framework of Environmental Administration in China

The organization framework of environmental administrative in china is shown in Figure 2-1.

2.1.2 Organization and Administrative Framework of the Project

Ministry of Finance of People's Republic of China (PRC), as delegate of borrower, is responsible for loan from the EIB and to transfer the loan to Inner Mongolia People's Government directly, PRC (IMPG). Finance Administration of IMAR will be taken charge of repayment of capital and interest on time to MOF, and will transfer the loan to Municipal Government. Subsequently, Municipal Government will transfer it to local banner/county governments and other relevant departments.

[SFA will be responsible for operational technology guidance in the project.](#) The vice chairman of IMAR will act as the group leader of leading group and be responsible for loan project, the leader of department of finance, development and reform commission, forestry department of IMAR as the vice group leader. The leading group was also established in municipal and so was Banner (county, region) related to the project. The project management office was set up in department of finance of IMAR, and City, Banner (county, region) also set up different level management office. The project implementation office was set up in forestry department of IMAR, which included expert panel, monitor group. Different level project implementation offices were set up in forestry departments in City, Banner (county, region). The organization framework of the project was shown in Figure 2-2.

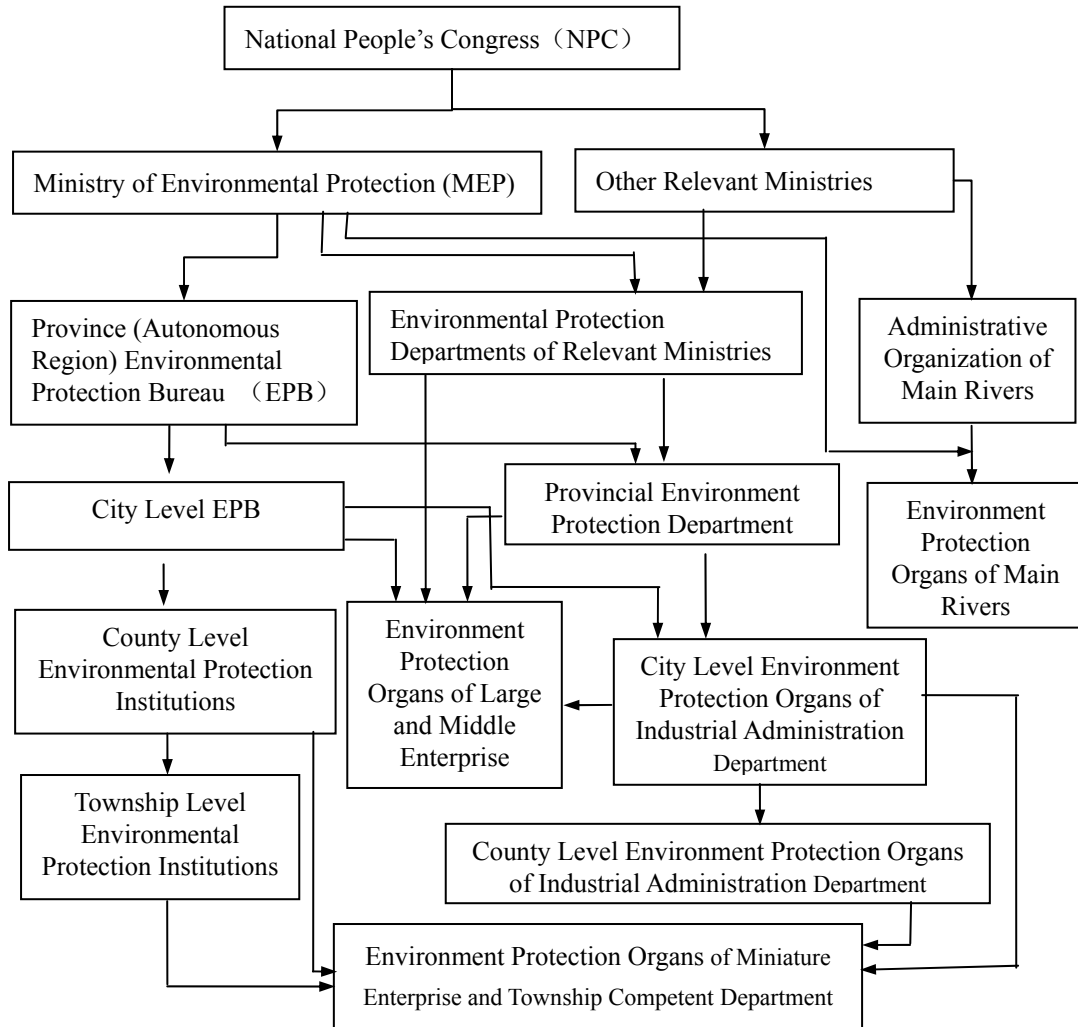


Figure 2-1 The Chart of Organization Framework of Environment Administration

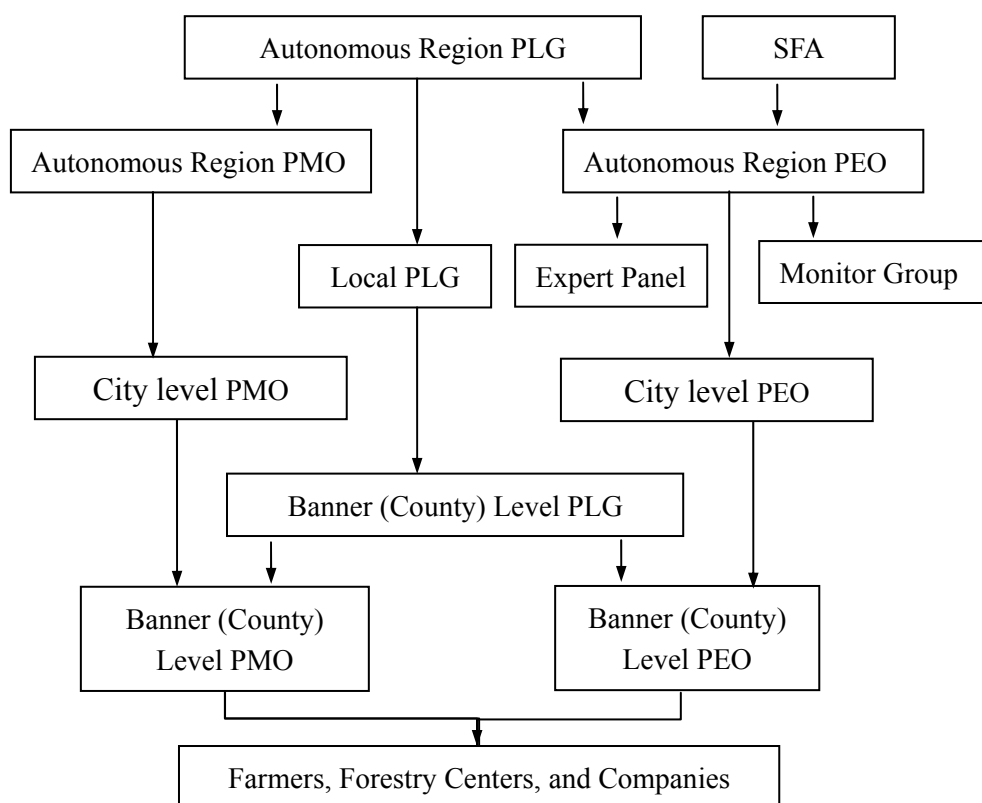


Figure 2-2 The Chart of Organization Framework of the Project

Every department in organization framework chart should be responsible for works to ensure the quality of the project, and the works of each department are listed as follows:

- (1) SFA: taking charge of declaration, professional guidance, overall management of the investment projects, and check and intendance and so on.
- (2) Autonomous Region Project Leading Group (PLG): examination and approval, evaluation work, settle the important problems, coordinate relations between departments, financial and benefit audit, supervising the counterpart capital and so on.
- (3) Autonomous Region Project Management Office (PMO): handle procedures for loan, implement capital and pay loan, financial management, purchasing apparatus and materials.
- (4) Autonomous Region Project Executive Office (PEO): compiling project management methods, plan for procurement and distribution, design for examination. Collect the progress of the project, check, benefit supervision, and the appraisal in

later stage. File management and training, etc.

(5) City Level PLG: cooperating with higher authority, coordinating relationships between different departments, putting into effect of the capital distribution and consuming, implementing the project management measures.

(6) City Level PMO: financial management of local area, implementation of capital and pay loan, procurement of the equipment and materials, supervision of the economical and financial activities.

(7) City Level PEO: check the implement of the design. Compile the local project implementation plans, annual implementation scheme, investment plans. Supervise the annual budget, and cooperate with higher authority.

(8) Expert panel: establish relevant standards, guidelines, measures, training materials, technical training. Supervise the quality of the project and check the monitoring data.

(9) Monitoring group: implement the assignments according to the monitor plans.

(10) Banner (county) Level PLG: put into effect the varieties of project management measures, set up matched rules and measures, and resolve the major problems met in the implementation of the project.

(11) Banner (county) Level PMO: financial management of local area, implementation capital and pay loan, procurement the equipment and materials, supervise the economical and financial activities.

(12) Banner (county) Level PEO: taken charge of implementation design. Compile the local project implementation plans, annual implementation scheme, investment plans. Sign the contract with the implementation department and farmers. Report the project progress report, Carbon sequestration management, distribution and granting.

From above duty of different departments, it can be concluded those clear duty and work range, including six parts such as planning management, project management, capital management, information management, operation and technology management, which formed a perfect organization framework for the project and investment plan.

2.2 Relevant Policy, Strategy, and Legislation

2.2.1 Relevant Policy and Strategic Guideline

- (1) The Outline of the Eleventh Five-Year Plan for National Economic and Social Development of the People's Republic of China, 2006.
- (2) The National Eleventh Five-year Plan for Environmental Protection, 2008.
- (3) Reply to Climate Change in China, 2007.
- (4) Decision on Accelerating the Development of Forestry formulated by the Central Committee of the Communist Party and the State Council of China, 2003.
- (5) The Plan of Eleventh Five-Years and Medium-Long Term Forestry Development, 2006.
- (6) The Outline of the Eleventh Five-Year Plan for National Economic and Social Development of Inner Mongolia Autonomous Region, 2006.
- (7) Resolution about Deepening Reform and Accelerating Forestry Development of Inner Mongolia Autonomous Region Party Committee and Government, 2003.

2.2.2 Relevant Laws

Relevant references are listed as follows:

- (1) The Constitution of the People's Republic of China, 1982.
- (2) Environmental Protection Law of the People's Republic of China, 1989.
- (3) Law of the People's Republic of China on Prevention and Control of Water Pollution, 2008.
- (4) Law of the People's Republic of China on Prevention and Control of Air Pollution, 2000.
- (5) Law of the People's Republic of China on Prevention and Control of Environmental Noise Pollution, 1996.
- (6) Law of the People's Republic of China on Prevention and Control of Solid Wastes Pollution, 1995.
- (7) Environmental Impact Assessment Law of the People's Republic of China, 2002.
- (8) Water Law of the People's Republic of China, 1988.

- (9) Law of the People's Republic of Soil and Water Conservation, 1991.
- (10) Law of the People's Republic of China on the Protection Wildlife, 1988.
- (11) Law of the People's Republic of China on Desert Prevention and Transformation, 2001.
- (12) Forestry Law of the People's Republic of China, 1998.
- (13) Labour Law of the People's Republic of China, 1994.
- (14) Law on the Protection of Disabled Persons, 1990.
- (15) Law of the People's Republic of China on the Protection of Minors, 2006.
- (16) Law of the People's Republic of China on the Protection of Rights, 2005.
- (17) Production Safety Law of the People's Republic of China, 2002.
- (18) The Law of Land Administration of the People's Republic of China, 2004.

2.2.3 Relevant Administrative Regulations

The referenced and relative administrative regulations to the project are listed as follows:

- (1) State Council PRC Decree No. [2000] 284, Rules for Implementation of the Law of the People's Republic of China.
- (2) NEPA Decree No. [1998] 253, Regulations on Environmental Management of Construction Projects.
- (3) State Council PRC Decree No. [1994] 167, Regulations of the People's Republic of China on Nature Reserves.
- (4) State Council PRC Decree No. [1996] 204, Regulations of the Peoples Republic of China on Wild Plants Protection.
- (5) State Council PRC Decree No. [1998] 257, Regulations on the Protection of Basic Farmland.
- (6) State Council PRC Decree No. [2000] 278, Regulations for the Implementation of Forestry Law of the People's Republic of China.
- (7) SFA [1989], Regulations on the Prevention and Control of Forest Diseases.

2.2.4 Relevant Government Department Rules

The referenced and relative government department rules to the project are listed as follows:

- (1) NEPA etc. Environmental Monitoring Order No. 324, Circular on Strengthening EIA Management of Construction Projects Financed by International Financial Organizations.
- (2) SFAC Decree No. [2007] 2503, Circular on Printing and Distribution the Project of Using the European Investment Bank loan to tackle Chinese Climate Change by State Development and Reform Commission.
- (3) State Council PRC Decree No. [1998] 111, Notification on Further Strengthen the Administration of National Natural Reserve.
- (4) State Council PRC Decree No. [2000] 38, National Eco-environmental Protection Program.
- (5) NPEA Decree No. [1997] 785, Opinions and Suggestions on Strengthening Ecological Protection Work”, State
- (6) NPEA Decree No. [2002] 14, List of Sort Management of Environmental Protection of Construction Projects.
- (7) State Council PRC Decree No. [1996] 31, Decision on Some Issues of Environmental Protection of the State Council of the People’s Republic of China.
- (8) NPEA Decree No. [1999] 61, Notice on implementation of “Administrative Rules for the Environmental Protection of Construction Projects”.
- (9) NPEA Decree No. [1999] 107, Notice of Relevant Issues on Implementing Environmental Assessment System of Construction Projects.
- (10) NPEA Decree No. [2006] 28, Temporary Provisions on Public Participation of Environment Impact Assessment.
- (11) The Outline of National General Land Use Planning (1997-2010), 2007.
- (12) Provisional Measures on Afforestation Quality Management, 2001.
- (13) The Engineering Project Land Use Indexes of Forestry Bureau, 1996.
- (14) The Project Construction Land Use Indexes of the Forest Area Power, Timber

Transportation, Forest Protection and Fireproofing and Airport Engineering, 1996.

2.2.5 Relevant Technical Guidelines and Standards

Several Technical Guidelines and standards for the project, which provide recommendations and obligations regarding the methodologies applicable for EIA studies, are listed as follows:

- (1) Technical Guideline for Environmental Impact Assessment, (HJ/T 2.1-2.3 93, HJ/T2.4-1995).
- (2) Technical Guideline for Environmental Impact Assessment / Ecological Environment and Natural Resources, (HJ/T 19-1997).
- (3) Regulation of techniques for comprehensive control of soil erosion, (GB/T16453.1-6-96).
- (4) Non-commercial forest construction--Technical regulation, (GB/T 18337.3-2001).
- (5) Artificial afforestation technical regulations, (GB/T 15776).
- (6) Code of forest harvesting, (LY/T1646-2005).
- (7) Regulations for tending of forest, (GB15781).
- (8) Design code for afforestation operation, (LY/T 1607-2003).
- (9) Tree seedling quality grading of major species for afforestation, (GB 6000-1999).
- (10) Tree seedlings of major species for afforestation, (GB 6000-85).

2.2.6 Relevant International Conventions and Protocols

The relative international conventions and protocols to the project are listed as follows:

- (1) United Nations Framework Convention on Climate Change, which was passed by the parties of the United Nations Framework Convention on Climate Change on May 22nd, 1997, was ratified at the conference of environment and development of the United Nations (the global leader conference) on Sep. 4th, 1992, held in Rio de Janeiro, Brazil.
- (2) Kyoto Protocol was passed at the 3rd Meeting of The Climatic Change Frame Convention of the United Nations held in Dec.1997, Kyoto.

2.2.7 Other Relevant Data

Besides those of referenced documents above, several more documents related to the ESIA are listed:

- (1) Feasibility Study Report on European Investment Bank Loan CDM Afforestation Project, FSDA, 2008.
- (2) Inner Mongolia Statistical Yearbook, 2007.

2.3 Relevant Technique Provisions of the EIB

According to the relevant provisions of the European Investment Bank on afforestation project, the report of environmental and social impact assessment in the present project was written on the basis of below documents.

- (1) Terms of Reference (TOR) of the Environmental and Social Impact Assessment about CDM Forestation Project Inner Mongolia Autonomous Region, EIB.
- (2) The Outline of the Environmental and Social Impact Assessment about CDM Forestation Project Inner Mongolia Autonomous Region, EIB.
- (3) Environment and Social Practices Handbook (ESPH) of EIB.
- (4) The environmental impact assessment processes as specified in the European Union Directive 2001/42/EC of European Parliament and of the Council of June 27, 2001.

3 Project Description

3.1 Project Description

3.1.1 Project Name

European Investment Bank loan Clean Development Mechanism (CDM) Afforestation Project.

3.1.2 Project Business and Technical Guidance Unit

State Forestry Administration, PRC (SFA).

3.1.3 Project Organization and Implementation Unit

Inner Mongolia Forestry Administration, PRC (IMFA).

3.1.4 Project Construction Units and Legal Representatives

People's Government of Hohhot Xincheng District	Xue Yanqun	(District Head)
People's Government of Hohhot Saihan District	Liu Jing	(District Head)
People's Government of Hohhot Helin County	Wu Zhiqiang	(County Head)
People's Government of Baotou Guyang County	Yang Zefan	(County Head)
People's Government of Tongliao Kerqin District	Yan Hongbo	(District Head)
People's Government of Tongliao Kezuohou Banner	Bao Fengshan	(Banner Head)
People's Government of Tongliao Kezuozhong Banner	Li Yanrong	(Banner Head)
People's Government of Tongliao Zhalute Banner	Lin Wenhui	(Banner Head)
Forestry Administration of Bayannaer City	Qian Yongxi	(Director General)

3.1.5 Project Property

The Carbon Sequestration could be increased by afforestation measures with the loans from EIB through this project. It is a new constructed carbon sequestration afforestation project of public interest, and taking ecological benefits and farmers' incomes into account.

3.1.6 Project Scope and Area

The project areas will be located in Hohhot City (Xincheng District, Saihan District, and Helin County), Baotou City (Guyang County), Tongliao City (Kerqin District, Kezuohou Banner, Kezuozhong Banner and Zhalute Banner), Bayannaer City (Desert Control Comprehensive Test Station). Locations of the project are shown in Map 1. The project sites' distributions of banners (counties, districts, station) are shown in Maps 2-7, respectively.

3.1.7 Project Implementation Duration and Schedule

Implementation duration: five years.

Implementation schedule: considering the needs of the project construction, vehicles, equipment and other infrastructure facilities are arranged as priority projects in the first two years of the construction. Forest road, fence and afforestation are arranged averagely per year. The detailed schedule of the project is shown in Table 3-1.

Table 3-1 The Project Construction Schedule

Project site		Scale (ha)	Construction progress (Ha)					Forest road (km)	Fence (km)
			2009	2010	2011	2012	2013		
Hohhot City	Xincheng District	1287.1	257.42	257.42	257.42	257.42	257.42	5	-
	Saihan District	117.4	57.4	60.0	-	-	-	-	-
	Helin County	830	166	166	166	166	166	18.4	18.8
	Subtotal	2234.5	480.8	483.4	423.4	423.4	423.4	23.4	18.8
Baotou City	Guyang County	15941.0	3188.2	3188.2	3188.2	3188.2	3188.2	-	-
Tongliao City	Keerqin District	1365.0	273	273	273	273	273	22.1	-
	Kezuozhong Banner	2811.4	562.3	562.3	562.3	562.3	562.3	45.6	-
	Kezuohou Banner	2880.0	576	576	576	576	576	46.7	-
	Zhalute Banner	2804.8	561.0	561.0	561.0	561.0	561.0	45.5	-
	Subtotal	9861.2	1972.2	1972.2	1972.2	1972.2	1972.2	160	-
Bayannaer City	Desert Control Comprehensive Test Station	3769.0	753.8	753.8	753.8	753.8	753.8	56.5	-
Total		31805.7	6395.1	6397.7	6337.7	6337.7	6337.7	239.9	18.8

3.2 Project Objectives

- (1) Explore the role of forestry in responding to climate change with domestic and foreign advanced technology and new mode of carbon sequestration afforestation.
- (2) Cultivate and manage multi-purpose plantations, improve forest quality, absorb carbon dioxide (CO₂) effectively and improve the capacity of coping with climate change according to the method of international carbon sequestration afforestation.
- (3) CO₂ is absorbed by forest restoration of the project area, then tests and demonstrates the decrease of greenhouse gas emissions in afforestation activities.
- (4) Heighten the level of technology and research coped with climate change in China, explore related technologies and methods of CDM carbon sequestration afforestation projects in the arid and semi-arid desert regions, calculate and monitor carbon sequestration, and test the trade of carbon sequestration in the actual operations.
- (5) Increase forest coverage, and management area of desertification is more than 30000 ha, and improve regional ecological environment through the project implementation.
- (6) Provide relevant technical guidance to departments and personnel and improve the overall accomplishment of people in project area by various levels of technical training, and expand employments and increase incomes of local farmers, herdsman, forest workers, and communities through forest road and infrastructure construction as well as afforestation.

3.3 Project Components

Implementation of the project includes carbon sequestration afforestation, construction of corresponding infrastructure and supporting facilities, personnel training and other constructions.

3.3.1 Project Contents and Scale

Main contents of the implementation of the project and its scale are shown as follows:

(1) multi-purpose afforestation

The total area of afforestation of the project is 31805.7 ha, all of which are suitable for woodland. The total areas of various species are shown in Figure 3-1.

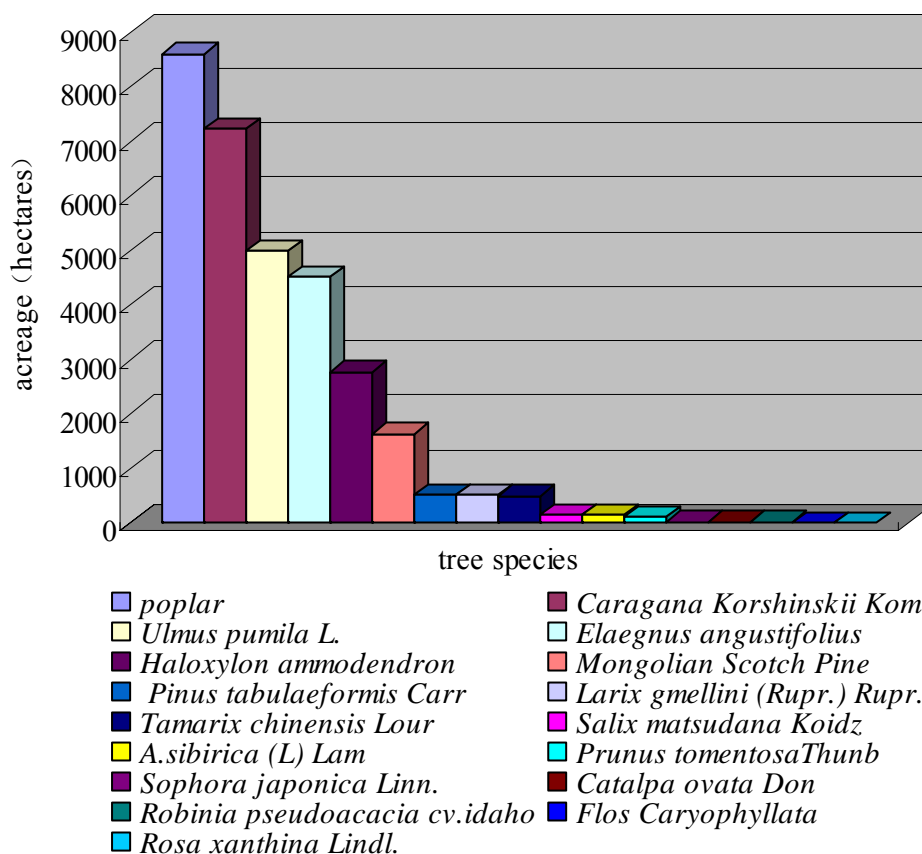


Figure 3-1 The Histogram of Tree Species and the Scale in Project Sites

(2) Capacity construction

Technical training and guidance: including technical training of various levels 14444 person-times and expert consultation 90 person-times.

Infrastructures and equipments: construction of 239.9 km forest road and fence of 18.8 km, 6 equipments for pest control, 7 machines for soil preparation, 7 pickup trucks, and 1 vehicle for transport, 9 tool cars and 6 cars for office are needed. Additionally, purchase production equipment, including 9 GPS, 1 portable computer, 4 computers (with printers), 1 digital camera and 4 copiers.

3.3.2 Project Investment

The total investment of the project is 378.628 million Y. Details of the investment are shown in Table 3-2.

Fund Sources: 265.001 million Y (25 million Euro¹) from EIB, accounting for 70% of the total investment, and 113.626 million Y from local finance, accounting for 30%.

Table 3-2 Estimate of the Investment

Item	Investment (million Y)	Investment composition (×10 ⁶ Yuan)		
		Construction and allocation	Device	Others
The total investment	378.628	290.762	9.326	78.540
Construction investment	349.221	290.762	9.326	49.133
Project costs	300.838	290.762	9.326	-
Afforestation	286.975	286.975	-	-
Capacity construction	13.863	3.787	9.326	0.75
Other costs	31.754	-	-	31.754
Basic preparation costs	16.630	-	-	16.630
Construction phase interest	29.406	-	-	29.406

3.4 Indicators of Project Success

There are three kinds of indicators of projects success: ecological benefits, economic benefits and social benefits.

3.4.1 Ecological Benefits

(1) Absorption and fixing CO₂. Through the implementation of the project, the net area of 31805.7 ha forestry will be increased. According to initially estimation, it will absorb and fix 280200 tons of CO₂ per year, and it could be effective on preventing the global warming.

(2) Beautifying and purifying the environment. The forest can absorb smoke and dust. Furthermore, some volatile substances are secreted from leaves such as terpene and

¹ Conversion rate: 1Euro = 10.6 Y

ozone, which hold strong ability to sterilization.

(3) Conservation of water and soil, shelter and immobility of sand soil. Almost of the project is located in the sand area. Vegetation of the project area will be increased after implementation of the project. Calculation based on forest's soil conservation of 3,000 cubic meters per hectare and the percent of soil immobility as 80%, the amount of sand immobility and soil conservation is 76.333 million cubic meters. It can be concluded that the project will effectively reduce soil erosion and desertification. After the forest closure, the project areas can reduce eolian erosion to crops as well as increase food and forage production. Supposing that a hectare of shelter forest protect 5 ha of the farmland or pastures, so 159000 ha of farmland and pastures will be protected by the project after completed, and the rate of increase production is 10 ~ 15%. Abundant shatter of forest each year fall down and synthesize with soil animals and microorganisms of soil nutrients circulatory system can increase soil fertility.

(4) Preservation of biodiversity. The afforestation sites are all wastelands that are proper for afforestation, most of which is sand area and biodiversity is in danger. Completion of the project will not only increase tree coverage, but also restore and protect the local biological gene pool. Besides, it can also create a good habitat environment for the surrounding wildlife resources and protect the local biodiversity.

3.4.2 Economic Benefits

The project's main forest products include forest carbon stock, timber, *Cistanche Deserticola* products and *Caragana Korshinskii Kom.* products. The products yield and the economy income are shown as follows:

(1) Forest carbon stock

Forest carbon stock contains the above ground biomass, below ground biomass, dead wood, tree shatter and soil organic matter. Because the project area is wasteland which is degradation, soil organic matter content is very low, and dead wood and tree shatter is little, the afforestation project will increase the carbon stock. According to conservative budget, calculation of carbon stock considers only the ground biomass

and underground biomass and the existing non-tree vegetation biomass will be deducted initially as emissions. The results of calculation show that the carbon stock of the arbor and shrubs are 4265141.96 tons and 904336.69 tons in 25 years of implementation period, respectively. That is the 280200 tons of CO₂ per year would be absorbed or fixed.

In the above calculation, owing that *Caragana Korshinskii Kom* needs stumping, and according to conservative budget, namely over-ground of *Caragana Korshinskii Kom* is considered as emission. And *Caragana Korshinskii Kom* carbon emission will be equal to carbon stock since the 9th year, so that the net carbon stock was zero between the 9~25th years.

(2) Timber

According to the area logging mode, logging period of the project are 12~16th years and 24~25th years, the logging areas are 1718.2 ha per year, and Poplar timber will be logged for 170100 cubic meters each year.

(3) *Cistanche Deserticola* products

Cistanche Deserticola will be produced from the 3rd year after vaccination. The annual yield is 750 kg/ha. After the fifth year of vaccination, yield would reach to 1500 kg/ha, that is, *Cistanche Deserticola* average annual yield gets to 41.535 million tons in the operation phase.

(4) *Caragana Korshinskii Kom* products

Caragana Korshinskii Kom products are the branches by stumping. The first-stumping is in the third year since planting, and after that, only one time of stumping per five years. The yield would reach to 45000 kg/ha, and the annual production is up to 651.15 million tons.

(5) Income

If profit of carbon sequestration is not considered during construction and operation phase, the total profit of the project amounts to 1195.707 million Y; rate of return on total investment yield is 18.3 %; internal rate of return is 12.5 %; the profit margin of

capital during prosecution is 15.4 %; financial net present capital (8 %) is 170.545 million Y; the reclaim period is 9.4 years (including the five-year construction phase).

If profit of carbon sequestration is considered, total investment yield is 21.9 %; finance inner yield is 13.0%; the profit margin of capital during prosecution is 19.1 %.

3.4.3 Social Benefits

The implementation of the project will play the leading role in carbon sequestration afforestation, management and trade for not only IMAR but also all the country. At the same time, the project will introduce a new ecological model for IMAR, and strengthen the ecological safety, effectively guarantee normal development of agriculture, animal husbandry and industrial production, improve rural production and living conditions, and increase rural income and local revenue.

The project areas locate in 4 cities (or leagues) and 9 banners (or counties, districts, and stations) of IMAR, where people hold single source of lives and low living standards. Due to the need of large number of labor every year in implementation phase, farmers in the project area will get more employed opportunities. The project requires a total labor of 1.772 million man-days: Hohhot project areas 248,000 man-days, Baotou project areas 693,000 man-days, Tongliao project area 517,000 man-days, Bayannaer project area 314,000 man-days.

Advanced foreign technologies and forest management experiences will be introduced, which will be helpful to the level of forest management and construction of efficient forestry. The project will organize technical training at various levels of 14444 person-times and expert consultation 90 person-times. A large number of high-level technicians of forestry science and technology management will be cultivated so as to improve management capacity of the implementation personnel.

3.5 Regional Distribution

Afforestation sites and tree species will be selected of this project on the principle of applying different approaches to different land, different trees and different

provenances. To maintain the health of forest, and satisfy construct objectives, the project will be tried the best to construct mixed forest with site character consistent with characteristics of selected species. Considering local resources characters, each afforestation mode will be determined. The specific modes of afforestation are shown in Table 3-3.

Table 3-3 The Mode of EIB Loan CDM Afforestation Project

Afforestation sites		Site conditions	Forest species	Afforestation mode		Planting density	Soil preparation methods	Seedling standards	Afforestation scale (ha)	Site Num.
				Tree species	Mode and ratio					
Hohhot	Xincheng District	low mountains and hills	shelter forests	I, II, III, IV	rows mixed 4: 4:2	2 × 4m	fish-scale pit	I: biennial vessel seedling Others: 1~2 year-old vessel seedling	I, II, III, 737.1 I, II, IV, 550.0	2
	Saihan District		shelter forests	V, VI	pure forest	2 × 3m	pit	biennial root biennial stem seedling	V, 23.0 VI, 14.0	1
			shelter forests	VII, VIII	patches mixed 1: 1	2 × 3m	pit	1~2 year-old vessel seedling	20.4	
			timber forests shelter forests	IX, V, X, XI, XII	pure forest	2 × 4m	pit	IX: biennial vessel seedling	V, 34.0 IX, 100 X, 26.0 XI, 4.0 XII, 20.0	
	Helin County		timber forests shelter forests	IX, V, X, XI, XII	pure forest	2 × 4m	pit	IX: biennial vessel seedling	696.0	3
			shelter forests	IX, VI	rows mixed 8: 2	2 × 4m	pit	IX: biennial vessel seedling VI: biennial root biennial stem seedling		
Baotou	Guyang County	hilly sloping land	timber forests	V	pure forest	2 × 4m	pit	biennial root biennial stem seedling	666.0	31
			shelter forests	XIII	pure forest	1 × 5m	fish-scale pit	1~2 year-old seedling	3275.0	
			shelter forests	XIV, XV, XIII	rows mixed 1: 2	1 × 5m	fish-scale pit	XIII: 1~2 year-old seedling Others: 1~2 year-old vessel seedling	XIV, XIII, 6000.0 XV, XIII, 6000.0	
Tong-liao	Keerqin County	gentle desert; immovable desert;	timber forests shelter forests	V, XIV	strips mixed 8: 2	2 × 4m	pit	V: biennial root biennial stem seedling XIV: 1~2 years' vessel seedling	667.5	160
			timber forests shelter forests	V, IX	strips mixed 8: 2	2 × 4m 3 × 4m	pit	V: biennial root biennial stem seedling IX: 2 biennial vessel seedling	667.5	
	Kezuohou Banner	semi-immovable desert or dune	timber forests shelter forests	V, XIV	strips mixed 8: 2	2 × 4m	pit	V: seedling with 2 roots and 2 haulm XIV: 1~2 year-old vessel seedling	1440.0	
			timber forests shelter forests	V, IX	strips mixed 8: 2	2 × 4m 3 × 4m	pit	V: biennial root biennial stem seedling IX: biennial vessel seedling	1440.0	

	Kezuozhong Banner	mobile dunes; lowland among sandy dunes	timber forests shelter forests	V, XIV	strips mixed 8: 2	2 × 4m	pit	V: biennial root biennial stem seedling XIV: 1~2 years' vessel seedling	1405.7	
			timber forests shelter forests	V, IX	strips mixed 8: 2	2 × 4m 3 × 4m	pit	V: biennial root biennial stem seedling IX: biennial vessel seedling	1405.7	
	Zhalute Banner		timber forests shelter forests	V, XIV	strips mixed 8: 2	2 × 4m	pit	V: biennial root biennial stem seedling XIV: 1~2 years' vessel seedling	1417.4	
			timber forests shelter forests	V, IX	strips mixed 8: 2	2 × 4m 3 × 4m	pit	V: biennial root biennial stem seedling IX: biennial vessel seedling	1417.4	
Bayan-naoer	Desert Control Comprehensive Test Station	mobile dunes; lowland among sandy dunes	shelter forests	XVI	pure forest	2.4 × 3.6m	pit	1~2 year-old vessel seedling	2769.0	1
			shelter Forests	XV, XVII	rows mixed 1: 1	2 × 4m	pit	1~2 year-old vessel seedling	1000.0	

Note:I, *Pinus tabulaeformis* Carr.II, *Larix gmellini* (Rupr.) Rupr.III, *A.sibirica* (L) Lam [*prunus sibirica* L]IV, *Prunus tomentosa* ThunbV, *poplar*VI, *Salix matsudana* KoidzVII, *Flos Caryophyllata*VIII, *Rosa xanthina* Lindl.IX, *Mongolian Scotch Pine* (*Pinus sylvestris* var. *mongolica* Litv.)X, *Sophora japonica* LinnXI, *Robinia pseudoacacia* cv. *idaho*XII, *Catalpa ovata* DonXIII, *Caragana Korshinskii* Kom.XIV, *Ulmus pumila* L.XV, *Elaeagnus angustifolius*XVI, *Caragana Korshinskii* Kom.XVII, *Tamarix chinensis* Lour.

4 Description of Existing Environment

4.1 The Major Geographic Regions

Major geographic regions of the project are Hohhot City(Xincheng District, Saihan District, and Helin County), Baotou City (Guyang County), Tongliao City (Keerqin District, Kezuozhong Banner, Kezuohou Banner and Zhalute Banner) and Bayannaer City (Desert Control Comprehensive Test Station). The regions of the project are described in Map 1.

4.1.1 Hohhot City

Hohhot City is located in the center of IMAR, at 110°46'~112°18' east longitude and at 39°35'~41°23' north latitude, administrating 4 districts, 4 counties and 1 banner. The total area is 17214 km², among them the area of urban districts is 2054 km². The project is located in the Xincheng District, Saihan District, and Helin County.

Xincheng District is located in the northeastern Hohhot city, facing Wuchuan County to the north and Zhuozi County of Wulanchabu City to the east divided by the Daqing Mountains, Huimin District to the west and Saihan District to the south. It is at 111°35'~112°5' east longitude and 40°48'~ 41°7' north latitude. The total area of the district is 700 km².

Saihan District is located in the eastern Hohhot, with the Wuchuan County and Daqing Mountains which is part of the east-west trend Yinshan Mountains to the north, Liangcheng County, Zhuozi County of Wulanchabu City and the Manhan Mountain to the east, Yuquan District and Xincheng District to the west and Helin County to the south. It is at 111°11'~112°10' east longitude and 40°36'~40°57' north latitude. The total area of the district is 1025 km².

Helin County is located in the southern Hohhot, with Saihan District and Tumote Left Banner to the north, Liangcheng County of Wulanchabu City to the east, Tuoketuo County to the west and Qingshuihe County and Shanxi Province to the south. It lies in southeastern Tumote Plain, northern Loess Plateau, and southwestern Manhan

Mountains. It is at 111°26'52"~ 112°18'11" east longitude and 39°58'11"~ 40°41'31" north latitude. The total area of the county is 3401 km².

4.1.2 Baotou City

Baotou City is located in the center of IMAR, with Mongolia to the north, Hohhot and Wulanchabu City to the east, Bayannaer City to the west and Ordos City to the south. It is at 109°16'~111°26' east longitude and 40°15'~42°44' north latitude. It administrates nine banners, counties and districts (Tuyou, Guyang, Jiuyuan, Shiguai, Damao, Donghe, Baiyun Mining District, Kun District, and Qingshan) with the total area of 28235 km². One project area is located in the Guyang County of Baotou City.

Guyang County is in the centre of Baotou City, and north of Daqing Mountains. It is at the upper and middle reaches of Yellow River, at 109°35'~110°43' east longitude and 41°42'~41°29' north latitude. The total area of the county is 4960 km², the width from north to south is about 60 km and the length from east to west is about 80 km.

4.1.3 Tongliao City

Tongliao is in eastern Inner Mongolia, adjoining Jilin Providence to the east and Liaoning Providence to the south. The city is in western Songliao Plain, central Keerqin Grassland, at 119°15'~123°43' east longitude and 42°15'~45°41' north latitude. It administrates Keerqin District, Huolinguole City, Kezuozhong Banner, Kezuohou Banner, Kailu County, Kulun Banner, Naiman Banner, Zhalute Banner. Fractional project is located in the Keerqin District, Kezuozhong Banner, Kezuohou Banner and Zhalute Banner.

Keerqin District is in the center of the Tongliao city with Kezuohou Banner to the south and east, Kailu County to the west and Kezuozhong Banner to the north. It is at 121°42'~123°02' east longitude and at 42°22'~43°58' north latitude. The total area of the district is 3520 km², the width from north to south is 68 km and the length from east to west is 107.5 km.

Kezuohou Banner is in the southeastern Tongliao city with Shuangliao city of Jilin

Province to the northeast, Zhangwu, Kangping and Changtu County of Liaoning Province respectively to the south and east and Keerqin District, Keerqin Left Middle Banner, Kailu County, Kulun Banner, Naiman Banner to the west and north. It is at 121°30'~123°42' east longitude and 42°40'~43°42' north latitude with the total area of 9811 km².

Kezuozhong Banner is in the east of Tongliao city with Kezuohou Banner and Tongliao city to the south, Kailu County to the southwest, Zhalute Banner to the northwest, Keyouzhong Banner and Tongyu County of Jilin Province to the north and Changling and Shuangliao County of Jilin Province to the southeast. It is at 121°08'~123°32" east longitude and at 43°32'~44°32' north latitude with the total area of 11570 km².

Zhalute Banner is in the northwestern Tongliao City and the south foot of Greater Xing'an Mountains, with Ar Keerqin to the west, with Keyouzhong Banner to the east and south and Huolin River to the north. It is at 119°14'~125°57' east longitude and at 43°50'~45°50' north latitude with the total area of 16520 km².

4.1.4 Bayannaer City

Bayannaer is in western Inner Mongolia. It administrates one district, two counties and four banners. It borders Mongolia to the north, Alashan League to the west, Wuhai City to the south and Baotou City to the east. It is at 105°12'~109°53' east longitude and 40°13'~42°28' north latitude. The total area of the district is 640 km², the length of border line is 368.89 km, and the length from east to west is about 378 km. The project site is located in the management area of the Desert Control Comprehensive Test Station.

Desert Control Comprehensive Test Station is at the north part of Wulanbuhe Desert, 20 km away from Bayangaole Town and 25.5 km away from Yellow River. It is at 106°28'21.7"~106°38'41.2" east longitude and 40°24'57.8"~40°29'20.2" north latitude with the total area of 102 km².

4.2 Ecological Environment

4.2.1 The Major Natural Vegetation Zones

The afforestation areas are wasteland with sparse vegetation since 1989. There are no rare or endangered species, so there is no effect on them of this project. The details on the vegetation zones are described in Map 8.

4.2.1.1 Hohhot City

The vertical zonation of Xincheng District and Saihan District is obvious: mainly are the meadow and grassland vegetations above the elevation of 1700 meters. The shrub vegetations are at the elevation scope of 1300~1700 meters, such as *Betula platyphylla* Suk., *Pobulus davidiana*, *Ostryopsis davidiana* Decaisne, and *Spiraea salicifolia* L.. Steppe as the main vegetations with some shrubs such as *Rosa xanthina* Lindl., *Ostryopsis davidiana* Decaisne below elevation of 1300 meters (the original vegetation of *Pinus tabulaeformis* Carr., *Juniperus rigida* Sieb, et Zucc and *Platycladus orientalis* (Linn.) Franco had been destroyed by arid climate). Vegetations on the plains had been replaced by crops with a few primary steppe vegetations such as *Leymus chinensis* (Trin.) Tzvel., *Artemisia sacrorum* Ledeb., *Stipa capillata* Linn., *Thymus vulgaris*, and *Radix Stelleriae Chamaejasmis*, with vegetation coverage around 65%.

The vegetations in the Helin County consist of 339 species of ferns and seed plants belonging to 214 genera, 65 families. The distribution of natural and artificial vegetations are mountain forest and bush grassland in southeastern lower mountains, hilly grassland in south-central loess hilly region, sandy grassland in sandy hilly region, lowland meadow fragmentary in shoal plain, gullies and low lands between mountains.

4.2.1.2 Baotou City

The natural zonation distribution of Guyang County is visible. However, transformation of natural vegetation is acute, for the primary forest is destroyed by human being and changed into secondary forest and then open forest and grassland. The major vegetations of Guyang County are open forest grassland, typical grassland,

river shoal grassland and mountain grassland, it is rich in plant resources, and there are 343 species of 200 genera in 62 families of wild plants, most of which are *Asteraceae* and *Poaceae* while in the next place are *Rosaceae*, *Leguminosae*, *Ranunculaceae*, *Chenopodiaceae*, and so on.

4.2.1.3 Tongliao City

Keerqin District is the zone of temperate grassland vegetations type, mainly including plain grassland and grassland of dune and wetland. There are plants such as *Leymus chinensis* (Trin.) Tzvel., *Stipa capillata* Linn., *Caragana microphylla* Lam., and arbor such as poplar, *Salix babylonica*, *Ulmus pumila* L., and *Pinus*.

The vegetations in Kezuohou Banner are xerophytic vegetations including meadow vegetations, sandlot and sand dune vegetations, shrub vegetations, and checkrow in forest such as *Leymus chinensis* (Trin.) Tzvel., *Stipa capillata* Linn., *Caragana microphylla* Lam., and arbor such as *Populus*, *Salix babylonica*, *Ulmus pumila* L., *Pinus*.

The vegetations in Kezuozhong Banner are xerophytic plants vegetations including meadow vegetations, sandlot and sand dune vegetations, shrub vegetations, and checkrow in forest such as *Leymus chinensis* (Trin.) Tzvel., *Stipa capillata* Linn., *Caragana microphylla* Lam., *Prunus ansu* Kom., *Lespedeza bicolor* Turcz., and arbor such as *Populus*, *Salix babylonica*, *Ulmus pumila* L., *Pinus*, etc.

The vegetations in Zhalute Banner are xerophytic psammophytic vegetations including *Prunus ansu* Kom., *Caragana microphylla* Lam., *Hippophae rhamnoides* Linn., *Herba Ephedrae*, *Stipa capillata* Linn., and *Artemisiascoparia* Waldst. EtKit, etc..

4.2.1.4 Bayannaer City

The vegetations in Desert Control Comprehensive Test Station of Bayannaer City are sparser from east to west along the Yellow River, including arbors plantation, natural bushes, *Polygonaceae*, *Poaceae*, *Leguminosae*, and *Gramineae* grass. There are desert plants such as *Artemisia desterorum* Spreng, *Nitraria tangutorum* Bobr., *Zygophyllum xanthoxylum* Maxim, *R. eaum u ria soong orica*, *Salsola passerina* Bse., *Haloxylon ammodendron*(C. A. Mey.) Bunge, *Ammopiptanthus mongolicus* (Maxim.) Cheng f.,

Potania mongolica Maxim. from east to west, and interspersing with Gramineae such as *Phyllostachys propinqua McClure*, *Phragmites australis(Cav.) Trin.ex Steud.*, *Setaria viridis (L.) Beauv.*. Vegetations in the proluvial fan of the northwestward are the desert grassland consisted of *Ammopiptanthus mongolicus (Maxim.) Cheng f.*, *Caragana Korshinskii Kom.* , *Zygophyllum xanthoxylum Maxim*, *Convolvulus tragacanthoides Turcz.*, *Potania mongolica Maxim.*, and so on.

4.2.2 Animals

In IMAR, there are 114 species of mammals belonging to 24 genera, accounting for 25.3 % of the whole mammals of 450 species. Amount of rodent of Inner Mongolia is 54 species, accounting for 35 % of Chinese totality, most of which are vermin. Rat is the dominant rodent in Inner Mongolia plain. There are 365 species of avifauna belonging to 51 genera, accounting for 31% of Chinese totality of 1186 species. The afforestation sites are wastelands without any forest. The habitat condition is so poor that few animal species are in the project area. According to survey, there are no rare and endangered species, so there is no effect on them of this project.

4.2.2.1 Hohhot

Xincheng District and Saihan District is rich in animal resources of over 170 species including *Cervus Axis*, *Procapra Gutturosa*, *Ovis Nahoos Szechuanensis*, *Meles Meles*, *Erinaceus Europaeus*, *Canis Lupus*, *Neofelis Nebulosa*, *Sciurus Vulgaris*, *Melanocorypha Monolica*, *Lophura Nycthemera*, etc.

In Helin County there are about 50 wild animals species mostly in the southeastern mountain areas including *Susscrofa*, *Capreolus Capreolus*, *Canis Lupus*, fox, Meles, hare, *AquilaClanga*, owl, *Citellus Dauricus*, pheasant, rock pigeon, corvidae, anser fabalis, *Passer Montanus*, snake.

4.2.2.2 Baotou City

In Guyang, the major wild animal includes *Capreolus Capreolus*, meles, Otus scops, hare , fox, *Alectoris Graecachukar*, eagle ,common magpie, *Corvidae*, *Citellus Dauricus*, snake, etc.

4.2.2.3 Tongliao City

Tongliao City is rich in animal resources, there are 185 species belonging to 65 families and 31 orders of animals, of which terrestrial vertebrates and mammals 33 species belonging to 25 families and 14 orders, fish 38 species belonging to 11 families and 5 orders, forest insects 255 species belonging to 57 families and 7 orders, natural enemy insects 86 species belonging to 21 families and 9 orders, rodents 24 species belonging to 15 genera and 8 families and 2 orders, fleas 33 species belonging to 6 families and 1 order, Arachnida 20 species belonging to 14 families and 8 orders, avifauna 222 species belonging to 49 genera and 19 families.

Wild animals mainly include *canis lupus*, *vulpes*, *mustela sibirica*, *capreolus*, *Procapra Gutturosa*, *Sus Scrofa*, *Ovis Tarda Linnaeus*, *Syrrhaptes Paradoxus (Pallas)*. Avifaunas includes *Melanocorypha Monolica*, etc.

4.2.2.4 Bayannaer City

The major wild animals in this city are *Anas platyrhynchos L.*, pheasant, hare, rat, etc.

4.2.3 Plantation Resources

The details of plantation resources in the project region are shown in Table 4-1.

Table 4-1 Plantation Resources in the Project Regions

Project regions		Plantation type	Total area (ha)
Hohhot	Xincheng District	shelter, economic, timber forests	10848
	Saihan District	shelter forests	4518
	Helin County	shelter, timber forests	126266
Baotou	Guyang County	shelter, economic, timber forests	44537
Tongliao	Keerqin District	shelter, economic, timber forests	59136
	Kezuohou Banner	shelter, economic, timber forests	161148
	Kezuozhong Banner	shelter, economic, timber forests	150270
	Zhalute Banner	shelter, economic, timber forests	70250
Bayannaer	Desert Control Comprehensive Test Station	shelter, economic, timber forests	179533

4.2.4 Natural Reserve

According to the general plan of the project feasibility study and the survey by forestry administrative departments at the banners and counties, there is no cultural natural reserve in the regions of the project (Map 9). Daqing Mountain National Nature Reserve is the only reserve which is near from the project area, but afforestation site of Xincheng District in Hohhot City is located in outside of the experimental region, which choose local tree species for afforestation and is divided into two areas. Every afforestation area is discontinuous small patch with the whole afforestation area of 12.871 km², and the nearer afforestation land is much smaller. So there is no effect on them of this project.

4.3 Physical Environment

4.3.1 Topography and Geology

4.3.1.1 Hohhot City

In Xincheng District there are mountains in the north and plain in the south. The mountains are denudation-tectonic low and middle mountains with highly precipitous declivity and ravine crisscross, and at elevation of 1100~2050 m. The plain is accumulative plain and piedmont alluvial plain at elevation of 1050~1200 m. The piedmont alluvial plain inclines from northeast to southwest, appeared zonary from east to west, with a loess hilly region in eastern piedmont.

The topographic of the Saihan can be divided into two parts: mountains of Daqing and Manhan lie in the north and east respectively, and Tumochuan plain in the south. Daqing Mountain and Tumochuan Plain are contacted with deep major fracture tectonic. The mountains are denudation-tectonic low and middle mountains, plain is accumulative plain and piedmont alluvial plain.

Helin is a part of Mongolian Plateau at the elevation of 1016~2028 m, which is high in the east and south, low in the west and north. There are loess and rock hills in transition zone between mountains to high plain and plain, infilling low mountains, valleys and

basins. In the southeast there are mountains with highly precipitous declivity, sharp ravine, and bare rock. In the middle-south there are hills with ravine crisscross, remarkably incised surface, low vegetation coverage and serious water loss and soil erosion. In the west there are flat plains with fertile soil.

The earth structure of Hohhot belongs to Yinshan platform and Hetao new fault of Inner Mongolia axis, which can be named as the central Asia and southern Asia parts of the central Yinshan-Tianshan earth structure. Under the influence of long term tectogenesis and magmatism, the geological structure is complicated with abundant nonferrous metals and nonmetals mineral resources of different scales. The stratum includes Archaean, Proterozoic and Cenozoic Erathem without Paleozoic erathem.

4.3.1.2 Baotou City

In Guyang County there are mountains in the south, plains in the middle, and hills in the north. The topography includes rock hill in the south and hilly area in the north divided by the southern Daqing Mountain, eastern Chunkun Mountain and central Daaobao Mountain. Mountains and hills account for 90% of the total area of the county, elevation of which is 1300~1700m.

Guyang located in western Inner Mongolia with the geological structure complicated. The strata are well developed from older to younger including ordinal upper Archean, lower Proterozoic, middle Proterozoic, lower Paleozoic, Mesozoic and Cenozoic erathem. The rocks outcropped in the area include magmatic rocks, glaucous rocks, metamorphic rocks, etc.

4.3.1.3 Tongliao City

Keerqin District located in Keerqin Desert with average elevation of 180 m. The district is high in the west and low in the east with a fairly flat sand dune. The topographies in the region include meadow plains, sandy dunes and sandy land.

Kzuohou Banner's topography belong to accumulative plain including sand hills, flat sandy land, lowland among sandy dunes, zonal valley plain. The banner is high in the west and low in the east with elevation of 88.5~308.4 m, and the extreme value of altitude difference in the whole banner is 219.9m. .

Kezuozhong Banner is high in the northwest and low in the southeast with the elevation of 123~230 m. The topography of the banner is flat covered mainly with fixed sand, semi-fixed sand and flowing sand dunes. The topography not only changes zonally, but also has differences of local.

Zhalute Banner located in the transition zone between Greater Hinggan and Songliao Plain. The banner is high in the northwest and low in the southeast including mountains, hills and sandy plain.

The strata in Tongliao development experiences ordinal Archaean, Mesozoic and Cenozoic erathem. It was covered with the geological structures belong to Songliao platform synclines, Jilin quasi fold belt and Inner Mongolia fold belt.

4.3.1.4 Bayannaer City

Topography of Desert Control Comprehensive Test Station is complicated. It is located at the transition zone between Ulan Buh Desert and Hetao Plain. There are desert, plain and mountain, with highest elevation of 2064 m.

Bayannaer is in the central west-to-east mountain range of Tianshan-Yinshan whose topography is complicated. The strata developed well ordinal Archaean, Proterozoic, Paleozoic and Mesozoic strata. There is Sino-Korean Peneplatform in the north and Tianshan-Xingan geosyncline fold belt in the south, with a boundary of Badan Jilin-Wulatehouqi-Kangbao-Chifeng-Changtu deep faults.

4.3.2 Climate

4.3.2.1 Hohhot City

Climate of Hohhot is a monsoon-influenced continental climate located in the temperate zone. The daily difference in temperature is great in spring, windy and rainless. It is rainy and hot in short-lived summer, temperature descending sharp and sunny in autumn, and cold and windy in lengthy winter.

The annual average temperature is 5.5°C in Xincheng District, 2~ 4°C in the mountains, 6.5°C in the plains. The temperature over 10 °C accumulates 2000°C~3000°C. The frost-free days are about 88 days in the mountains, 135 days in the plains every year.

The average annual rainfall is 395mm. The annual average wind speed is 2.0m/s in the plains and 3.5m/s in the mountains. The average annual hours of sunshine are 2970.5 hours.

In Saihan District, the annual average temperature is 5.5 °C; the temperature over 10 °C accumulate 1800°C~3000°C; the average annual frost-free days are about 135 days; the average annual rainfall is 420mm; the average annual amount of evaporation is 1839mm; the annual average wind speed is 2.0m/s; the average annual hours of sunshine are 2970.5 hours.

In Helin County, the annual average temperature is 4.8~8.2 °C; the highest temperature is 37.5 °C; the lowest temperature is -34.5 °C; the average annual rainfall is 392.6mm; the average annual amount of evaporation is 1850mm; the annual average days on strong wind are 14 days, the most is 28 days and the annual average days on sandstorms are 9.6 days.

4.3.2.2 Baotou City

Guyang's climate is a continental climate located in the temperate zone. It is rainless and windy in spring, rainy in short-lived summer, frost-early in autumn, and cold in lengthy winter. There are full of sunshine, wide difference in temperature between day and night, and lots of fine days. The annual average temperature is 5°C~2.5°C; the highest temperature is 36.6°C; the lowest temperature is -36.1°C; the average annual rainfall is 225~375mm, and most from June to August; the average annual frost-free period is about 109 days and the average annual hours of sunshine are 2872.6~3306.4 hours.

4.3.2.3 Tongliao City

Keerqin's climate is a continental climate located in the temperate zone. It is rainless and windy in spring, hot and rainy in short-lived summer, cool in autumn, dry and cold in lengthy winter. The annual average temperature is 7.3°C; the highest temperature is 39.1°C; the lowest temperature is -30.9°C; the temperature over 10°C accumulate 3148.6°C; the average annual hours of sunshine are 3094 hours; the average annual rainfall is 350~450mm; the average annual amount of evaporation is

1940mm; the annual average wind speed is 3.5m/s; the annual average days on sandstorms are 10~12 days and the days when wind-force level are equal or beyond 8 are over 29 days on average every year.

Kezuohou Banner's climate is a continental climate located in the temperate zone. The annual average temperature is 5.8~5.9°C; the temperature over 10 degrees accumulate 3032~3168°C; the average annual rainfall is 350~400mm; the average annual hours of sunshine are 2837~2982 hours; the average annual frost-free days are about 145~148 days; the soil-frozen days are 150 days over.

In Kezuozhong Banner the annual average temperature is 5.8~5.9°C; the temperature over 10 degrees accumulate 3032~3168 °C; the average annual forest-free days are about 130~143 days; the average annual rainfall is 350 mm; the average annual frost-free days are about 130~143 days; the soil-frozen days are 150 days over.

In Zhalute Banner, the annual average temperature is 5 °C; the temperature over 10 degrees accumulate 3100~3400°C; the average annual rainfall is 350~400mm; the average annual amount of evaporation is 1750~2000mm; the annual average wind speed is 3~4.4m/s; the average annual hours of sunshine is 3100 hours and the average annual frost-free period are about 130 days.

4.3.2.4 Bayannaer City

In Desert Control Comprehensive Test Station regions, the climate is a continental climate located in the temperate zone, the annual average temperature is 7.6°C; the average annual rainfall is 159.7mm; the average annual amount of evaporation is 20327mm; the average annual hours of sunshine is 3210 hours; the average annual frost-free days are about 136 days; the deepest frozen soil layer is 58cm; the annual average period of blowing dust is 11 days, and sandstorm is 3 times.

4.3.3 Soils

The characteristics of the soil in the afforestation project refer to the soil distribution of IMAR are shown in Map 10.

4.3.3.1 Hohhot City

The soil types in Xincheng and Saihan District are rich, gray-cinnamon forest soil and gray cinnamonic soil in mountains; chestnut-cinnamon soil, gray meadow soil, meadow marsh soil, skeletal soil in hilly area; siltation chestnut-cinnamon soil, sandy and stony soil in plain. The gray-cinnamon forest soil and gray cinnamonic soil contain high organic matter content with thick humus layer. It is obvious that the soil is of vertical distribution. There are herbiferous gray-cinnamonic soil above elevation of 1700 m, eluvial grey-cinnamonic soil at elevation of 1300~1700 m, typical gray-cinnamonic soil below the elevation of 1300 meters with a pH of 6.5~7.5 and a thickness equal or greater than 20 cm.

The soil types in Helin County are varied. There are chestnut-cinnamon soils in shady slope of the southeastern mountains, aeolian sandy soil in beach land and south-central hilly areas.

4.3.3.2 Baotou City

The soils in Guyang County belong to 3 soil groups, 9 subgroups, 23 soil great groups and 81 species. It is obvious that the soil has a horizontal and vertical zonality. There is gray cinnamonic soil in southeastern mountains, typical chestnut soil in northern hilly areas, and meadow soil in central beach.

4.3.3.3 Tongliao City

The zonal soil of Keerqin District is typical chestnut soil including meadow soil and aeolian sandy soil. There are meadow soil in flood low land and foothill low land, aeolian sandy soil in western, northern and southeastern Keerqin.

The soils in Kezuohou Banner belong to 5 soil groups, 8 subgroups including the aeolian sandy soil, typical chestnut soil and cinnamon soil as majority and some meadow soil, bog soil and saline soil in the river beach.

The azonal soil and zonal soil widely developed in Kezuozhong Banner including typical chestnut soil as majority and interlace with some azonal soil such as aeolian sandy soil, gray meadow soil, tinted meadow soil, bog soil, saline soil, etc.

There are 11 soil groups in Zhalute Banner including typical chestnut soil as majority

then some brown soil and aeolian sandy soil, etc.

4.3.3.4 Bayannaer City

Desert Control Comprehensive Test Station situated on the Yellow River alluvial plains. The soils belong to anthropogenic alluvial soil, grey desert soil, saline soil, aeolian sandy soil, etc. The major soil forming processes include sandy desertification, siltation, desertification, humus accumulation, eluviation and illuviation, salination and the process of becoming to meadow.

4.3.4 Hydrology and Water Resources

The characteristics of the hydrology and water resources are different in the vast regions of the project, and the details on the water resources are shown in table 4-2.

Table 4-2 Water Resources of the Project Regions

Project region	Ground water ($\times 10^4$ tons)	Surface water ($\times 10^4$ tons)
Hohhot City	128601.5	43757.7
Baotou Guyang County	7800	6012
Tongliao City	269700	55100
Bayannaer City Desert Control Comprehensive Test Station	-	-

4.3.4.1 Hohhot City

In Xincheng District the buried depth of groundwater is indefinite, above than 100 m at a height somewhere and existing conduit in the some low-lying land. In plains the groundwater resource is plentiful, phreatic level is above 10 meters. The surface water resource is lack with only 6 biggish seasonal brooks, and the major water source is rainwater during the rainy season while partially from mountainous spring.

The Saihan District is rich in groundwater resource. Water in shallow layer is buried in gravel from alluviation. There are 3 seasonal rivers flowing from east to west.

The groundwater is not evenly distributed in Helin County, most of which is in plains and little in hilly. The surface water resource is rich with 4 reservoirs and 5 rivers.

4.3.4.2 Baotou City

The groundwater is not evenly distributed in Guyang County, most of which is in plains

but little in hills areas and mountainous regions. There are 6 seasonal rivers in the region with a flow depending on rainfall. In normal time the flow is little. During the rainy season in July and August, the flow is as high as thousands cubic meter per second when mountain torrents swept down by heavy rain. The Kundulun River, Wudanggou River, Meidaigou River and Wusutule River in the region all are the tributaries of the Yellow River.

4.3.4.3 Tongliao City

The groundwater resources of Keerqin District are rich with a fairly good quality, and the buried depth of the groundwater is 2~5 m. Because of the geography and climate, the surface water resource is lack in the region with only two seasonal flood-relief channels, the Qing River and Xiliao River. There are two periods of flood discharge every year, and the Xiliao River has remained low water for three years now. There are three reservoirs in the region, such as Molimiao Reservoir, Xiaotazi Reservoir, and Tuerjishan Reservoir.

In Kezuohou Banner there are 11 rivers with a cumulative length 1188.5 km, including Dongliao River, Xiliao River, Hong River, Qinggou River, Wujiazi River, Chaolutu Inland River, etc. There are five main flood-relief channels, Gantie, Xinmin, Ganji, Yiliao, Baliao traversing the region which links a number of rivers and lakes.

The water resources in Kezuozhong Banner are rich. The total amounts of groundwater are 274 million cubic meter, the annual average amounts of surface water are 1587 million cubic meters, and the average water resource is 224 thousand cubic meters per square kilo meter. The three main rivers are Xinkai River, Wulijimuren River and Liao River. The storage capacity of reservoir is below 100 million cubic meters.

The water resources of Zhalute Banner are rich. There are Liao River water system including Wulugeqi River, Lubei River, Baiyinjulu River, Bayantala River, and Ailin River, with a total length of 510 km and an annual runoff of 410 million cubic meters. It has built a medium scale reservoir able to hold 22.15 million cubic meters of water, and six small reservoirs able to hold 10.88 million cubic meters of water.

4.3.4.4 Bayannaer City

The Yellow River is the main surface water in Bayannaer flowing from south to northeast, with an annual flow of 31,000 million cubic meters. The water from the Yellow River is used for irrigation through five main ditches. A complete irrigation system is made up of the main ditch, the branch ditches and many water channels through which water is diverted into the cultivated fields.

4.4 Socio-Economic Condition

4.4.1 Population and Ethnic

IMAR mainly includes the Mongolians, Manchu, the Hui and the Han, while the Mongolians are the main body, and the Han is the majority. Ethnic groups and population distribution in the project region at the end of 2006 are shown in Table 4-3.

From Table 4-3, it can be found that the minority population of Tongliao city is more, especially in Zhalute Banner, where the minority accounting for over 75% of the population. Rural population is the majority, while the poor is comparatively more. In 2006, income criterion of absolute poverty population in the Farming and Pasture Region of Inner Mongolia is 693 Y, and criterion of low-income population is 958 Y. With the overall start of lowest-life-security system in Rural Pastoral Area, peasants whose families' annual average income was less than 625 Y and herdsmen with families' annual average income less than 825 Y will be involved into the scope of protection firstly, and subsidy of every person will no less than 360 Y every year.

Table 4-3 Population Distribution in the Project Regions

Project Region		Numbers		Population(× 10 ³)					Ethnic groups distribution
		Towns	Villages	Total	Rural	Poor	Minority	Female	
Hohhot	Xincheng District	2	30	333	49	7.9	68	166	It is an area inhabited by the 38 ethnic groups including the Mongolians, the Han, the Hui, and Manchu ethnic groups. Xincheng District is Manchu-inhabited area.
	Saihan District	6	124	373	133	23.0	62	183	
	Helin County	6	150	187	152	30.0	31	88	
Baotou	Guyang County	6	104	177	132	17.0	2	78	It is an area inhabited by the different ethnic groups including the Han as the majority, the Hui, Manchu, and the Mongolian.
Tongliao	Keerqin District	10	450	813	485	1.7	187	403	It is an area inhabited by different ethnic groups including the Mongolians as the main body, the Han as the majority.
	Kezuohou Banner	12	306	398	332	81.0	198	194	
	Kezuozhong Banner	15	551	527	445	59.5	262	258	
	Zhalute Banner	11	258	305	247	33.4	231	149	
Bayannaouer	Desert Control Comprehensive Test Station	-	-	0.066	-	-	-	-	The Han are in the majority.

4.4.2 Culture Background

4.4.1.1 Hohhot City

Hohhot City is the capital and the administrative, economic and cultural center of IMAR. There are over 10 universities and many research institutions located in Hohhot include agriculture, forestry, animal husbandry and water conservancy, such as Inner Mongolia University and Inner Mongolia University of Agriculture. Lately, the social undertakings of science and technology, education, culture, public health and sports have developed rapidly, and people's cultural life has become increasingly rich and colorful.

4.4.1.2 Baotou City

The area now known as Baotou City was inhabited since ancient times by nomads, most notably the Mongols. Human activity in Guyang County began in the Neolithic period; there is the largest and best-preserved Tibetan-style lamasery in the entire autonomous region-Bad Ger (Wudang) Lamasery. There are a group of literary and art professionals and a team for mobile movie to enrich citizen's culture life, and the annual times of film screened there is about 1500. Cultural centre is the centre of wrinkly and agedness activity, and training of children dance, vocality, instrumental music and painting and calligraphy. The library including reading room, borrow-reading room, book collecting room and electronic reading room has a collection of 13000 volumes and 1000 kinds of books, receiving readers 30000 man-times annually. There are 108 elementary schools and high schools. Enfant of the right age enrollment rate is 100%; junior high school enrollment rate is 99.82%; handicapped enfant and youth actual enrollment rate is 100%. There is no illiteracy of 15 years old. Confirmation rate of off- illiteracy is 99.4%, the first Mongol school was founded in 1981.

4.4.1.3 Tongliao City

Tongliao City is one of the cradles of Hongshan and Fuhe Culture with a long history. The historical relics and sites such as Great Wall of Yan State, boundary moat of Jin

Dynasty, Painted Tombs of Liao Dynasty, Buddhist tower of Yuan Dynasty and mansion of Qing Dynasty liege are remained today.

Inner Mongolia University for Nationalities and Inner Mongolia College of Farming and Animal Husbandry are among the educational institutions of Tongliao. There are 9 artistic performer groups, 1 culture centre, 1 mass art museum, 1 public library and 3 museums in Tongliao city. And there are 1 college of higher education and 1 school of special education, which is help for education of students for school age. Enfant of the right age enrollment rate is 100%. Up to end of 2006, there are 242 sanitation institutions.

4.4.1.4 Bayannaer City

Bayannaer City has a long history with a fusion of grassland culture, Hetao Culture and the Wulate ethnic song and dance. The famous interests mainly include Bayinmanduhu Dinosaur Fossil Region, Yinshan Cliff painting, Han Tombs, Ancient Great Wall, Jilu fortress, Gaoque fortress and some other ancient city sites or ancient temples.

It is paid attention to construction of museum, culture centre, library and grass roots culture, a series of projects are organized ordinal, such as Rainbow Culture Plan, Border Culture Lengthy Corridor Construction Program and Grassland Book House Project, etc. there are 436 elementary and high schools in Bayannaer. Up to 2000, compulsory education carried out in this city.

4.4.3 Infrastructure

In the project areas, there are well-developed infrastructure including electric power, transportations and communications, so it can be very convenient for the production transportation and sale. The modern communication facilities are completely available with the programmed-control telephone widespread around the county, and the supply of electricity and heat are adequate.

Hohhot City is the administrative, economy, culture and transportation center of IMAR. The city zone traffic principal axis was formed with Zhongshan Road, Xilin Road and

Xinhua Street as the centre. A crisscrossing network of highways with a railway traverses the urban area, such as the Jingbao Railway and Jingbao highways from Beijing to Baotou.

Baotou City is the base city of heavy industry in IMAR. Every county traverses crossing road. The pattern of the south-to-north and east-to-west road as the centre and radiating to county road has been formed.

Tongliao City is a famous grain and pasture base, and have a crisscrossing network of highways traversing the urban area with a well developed transportation industry.

Banyannaer City is a famous grain-produced base with convenient communications, and there are Jingbao Railway from Beijing to Baotou, Lince Railway, Jingzang highway and 110 National highways.

4.4.4 Land Tenure and Land Ownership

According to Chinese law, the ownership of the degenerative hills and lands can be divided into 3 different types: state-owned, collective and contracted with the users. Based on the survey, the plots of this project refer to just the state-owned and collective, of which 51 plots are state-owned and 147 plots belong to collective, the details on them are shown in Table 4-4.

Table 4-4 The Construction Scale and Land Ownership of the Project

Project regions		Size (ha)	Proportion (%)	Site Num.	Ownership
Hohhot	Xincheng District	1287.1	4.0	2	State-owned
	Saihan District	117.4	0.4	1	Collective
	Helin County	830.0	2.6	3	Collective
Baotou	Guyang County	15941.0	50.1	31	Collective
Tongliao	Keerqin District	1365.0	4.3	160	48 state-owned plots; 112 collective plots.
	Kezuohou Banner	2811.4	8.8		
	Kezuozhong Banner	2880.0	9.1		
	Zhalute Banner	2804.8	8.8		
Bayannaer	Desert Control Comprehensive Test Station	3769.0	11.9	1	State-owned

Total	31805.7	100	100	198	
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4.4.5 Land Utilization

The land utilization in the project is shown in Table 4-5.

The main crops in the project region are wheat (*Triticum aestivum*), core (*Zea mays L.*), *Fagopyrum Mill*, *Avena chinensis*, *Sorghum Vulgare*, *Setaria Italica*, *Solanum Tuberosum*, etc. The main cash crops include Oil Sunflower, *Lavatera arborea*, *Brassica campestris L.*, *Linum usitatissimum Linn.*, sugar beet (*Beta vulgaris*), etc. The cropping system belong to one crop a year, the crops are sown in spring and harvested in September or October.

Table 4-5 The Land Utilization in the Project Regions

Project region		Total area (ha)	Forest land (%)	Cultivated land (%)
Hohhot	Xincheng District	70000	67.31	15.50
	Saihan District	102500	31.93	42.39
	Helin County	340100	45.72	31.12
Baotou	Guyang County	496000	28.65	3.85
Tongliao	Keerqin District	352000	23.86	34.94
	Kezuohou Banner	981100	44.37	14.07
	Kezuozhong Banner	1157000	38.03	17.63
	Zhalute Banner	1652000	51.94	5.81
Bayannaouer	Desert Control Comprehensive Test Station	11066	100.00	0.00

4.4.6 Economic Condition and Income Sources

The details on the gross economic, economic structure and income sources of the project regions are shown in Table 4-6. By comparing annual average income of minority, peasants and herdsmen in the project area of banners, counties and districts, it was found their annual average income are equal to each other and are all higher than low-income population of 958 Y. On the whole process of this project, the interests of minority will be given prior consideration, especially the poverty population.

Table 4-6 The Income Conditions in the Project Regions

Project regions		Output value				Total livestock iumber ($\times 10^4$)	Total grain output (ton)	Annual minority income (Yuan)	Annual farmers and herdsmen's income (Yuan)
		Total ($\times 10^4$ Yuan)	Primary industry (%)	Secondary industry (%)	Tertiary industry (%)				
Hohhot	Xincheng District	1900641.0	0.53	12.82	86.65	6.2	26183.0	7597	7597.0
	Saihan District	1561600.0	5.65	28.07	66.28	25.8	107000.0	5898	6530.0
	Helin County	780309.0	11.62	68.10	20.27	25.8	181601.0	5082	5082.0
Baotou	Guyang County	305177.0	15.73	61.34	22.93	24.5	886902.0	3800	4615.0
Tongliao	Keerqin District	1553305.0	15.85	50.69	33.46	167.0	886902.0	4358	4816.0
	Kezuohou Banner	467252.0	26.80	25.47	47.73	116.4	738500.0	3106	3166.0
	Kezuohong Banner	395495.0	35.21	24.26	40.53	149.3	795002.0	2867	3376.0
	Zhalute Banner	343040.0	31.78	25.56	42.66	199.6	319247.0	3598	3625.0
Bayannaer	Desert Control Comprehensive Test Station	-	-	-	-	-	-	-	-

4.5 Cultural Relics and Historic Sites

There is no cultural relic, historic site and scenic spot in the regions of the project (Map12), so there is no effect on them of this project.

5 Public Consultation

5.1 Consultation Method and Subject

5.1.1 Purpose

According to the relevant provisions of the Desert Control Comprehensive Test Station “*Regulations on the Management of Environmental Protection in Construction Projects*”, relevant requirements of EIB and the Technical Guideline for Environmental Impact Assessment, embodying the openness and justice of this project, ESIA team organized extensive public consultation in the possibly affected region to provide basis for project management and decision-making.

The project is a CDM afforestation project which will improve the ecological environment of IMAR. The purpose of the consultation is to make nearby communities and the public understand the characteristic and the possible environmental and social impact of the project, and feed back the summarized opinions and suggestions of public to the implement organization timely. Full consideration should be given to those opinions and the reasonable proposals during the project decision, to make the project planning and design more reasonable. Public consultation is help to improve the quality of ESIA, ensure the openness and credibility of the assessment and the project decision.

5.1.2 Consultation Method

According to the requirements of EIB and the “*Environmental Impact Assessment Law of the People’s Republic China*”, the following methods were used: posting notices in the project areas; information issuance via the Internet; granting the public questionnaire; holding consulting conferences; interviewing the local forestry and environmental protection administration departments; seminars combined with individual consultation; visiting a number of farmers.

Investigations focus on the following aspects:

- (1) Existing farmland or forestland, labor force, income, living standard of the local farmers (forest farmer, herdsman), and their attitude to this project.
- (2) Socio-economic structure and the gross economy of township, land-use planning, the present cultural education and social security situation, the attitude to this project.
- (3) The possible positive or negative, short-term and long-term impacts on farmers in the course of afforestation.
- (4) Social risks and conflicts exist in choice of plantation sites and farmers participating in the project, the desire of farmers and coordinated measures prepared by local government departments of all levels.

5.1.3 Consultation Scope

5.1.3.1 Investigation of Families and Individuals

The families and individuals to be investigated included all the banners, counties, districts, forestry centre and test station of the project, namely: Hohhot (Xincheng District, Saihan District, and Helin County), Baotou City (Guyang County), Tongliao City (Kerqin District, Kezuohou Banner, Kezuozhong Banner, Zhalute Banner), Bayannaer City (Desert Control Comprehensive Test Station). The primary methods are posting notice and granting the public questionnaire in the 9 blocks with a random sampling way. Totally 245 questionnaires were sent out, and 241 effective questionnaires were received, including the stakeholders of all levels, especially the minority and women. The details on the objects of investigation are shown in Table 5-1.

Table 5-1 The Composition of the Investigated Subjects

Composition \ Structure		Resident of the project area (Num.)	Proportion (%)	Implement people (Num.)	Proportion (%)	Total (Num.)	Total percentage (%)
Sex	Male	96	39.83	50	20.75	146	60.58
	Female	72	29.88	23	9.54	95	39.42
Age groups	Below 18	1	0.41	0	0.00	1	0.41

	18~30	21	8.71	21	8.71	42	17.43
	31~45	105	43.57	38	15.77	143	59.34
	Above 45	41	17.01	14	5.81	55	22.82
Educational level	University (including junior college and above)	36	14.94	28	11.62	64	26.56
	High school	37	15.35	34	14.11	71	29.46
	Middle school	64	26.56	10	4.15	74	30.71
	Primary school and the below	15	6.22	1	0.41	16	6.64
Profession	Cadres	33	13.69	9	3.73	42	17.43
	Experts and technical staff	11	4.56	34	14.11	45	18.67
	Farmer (herdsman, forest farmer)	106	43.98	18	7.47	124	51.45
	other	21	8.71	2	0.83	23	9.54
Nation	Mongolian	93	38.59	38	15.77	131	54.36
	Han	51	21.16	32	13.28	83	34.44
	other	24	9.96	3	1.24	27	11.20
Living region	Hohhot Project area	63	26.14	21	8.71	84	34.85
	Baotou Project area	30	12.45	0	0.00	30	12.45
	Tongliao Project area	72	29.88	50	20.75	122	50.62
	Bayannaer Project area	2	0.83	3	1.24	5	2.07
Total		167	69.29	74	30.71	241	100.00

5.1.3.2 Investigation of Non-Governmental Organization

Japan Bank for International Cooperation (JBIC) ecological environment regulation project of IMAR was completed during 2002-2006. Helin County had accumulated some experience as one of the project regions, so it was chosen as the representative area of the public consultation. With the help of Forestry Bureau of Helin County, we invited stakeholders of the afforestation project from all levels, and held consulting

conferences about environmental and social impact to solicit suggestions of the non-governmental organization representatives. The original materials are shown in Annex D. In addition, we solicit comments and suggestions from the relative professional experts of some scientific research units and universities through interviews, telephone and Internet.

5.1.3.3 Investigation of Governmental Organization

In the course of consultation of government organization, IMFA and IMEPB were visited first. And then Guyang County and Helin County were chosen as the representative of banners or counties, for the worse ecological conditions, and the successful shelterbelts of *Caragana Korshinskii Kom* in Guyang. The views and suggestions of the project were listened to from executive leaders and technologists during visited Forestry Bureau and relative environmental protection administration.

5.2 Information Disclosure and Feedback

5.2.1 Information Disclosure

(1) A text entitled “EIB investigated carbon sequestration afforestation of Inner Mongolia Autonomous Region” was published in China Green Times on June 20th, 2008, (issue 2538, website: <http://www.greentimes.com>). This text announced the pre-inspection about the afforestation project. Subsequently, the relative information was promulgated on the website of SFAC, IMFA and responsible forestry administration of this project.

(2) On July 28th to 30th, 2008, the members of ESIA team visited executive leaders, experts, technologists and forest workers of the local forestry bureau and environmental protection administration of Hohhot City and Guyang County, Baotou City, respectively. We also made a field investigation on the afforestation, listened to their suggestions on this project.

(3) On August 21st to 23rd, 2008, the members of ESIA team organized consulting conferences of the local forestry administrations, non-governmental organizations,

farmers, minorities and other delegates in Hohhot City, Helin County and listened to the suggestion of them. The original materials are shown in Annex D.

(4) On August 25th to 27th, 2008, we posted notices of the project's public consultation in the 9 blocks of the project at the same time, granted questionnaires, and then collected the questionnaires for statistical analyses.

(5) On September 4th to 9th, online information of ESIA about the project was announced in IMFA official site. The original materials are showed in Annex D.

5.2.2 Feedback

After the issuance of information, individuals of all levels in the project areas fed back their suggestions through the following methods: speeches, interviews, questionnaires, telephone, and Internet message board.

5.2.3 Feedback of Consulting Conferences and Interviews

Through the consulting conferences in Helin County and Guyang County, the communities of different classes who were invited have put forward their views and suggestions, which are summarized as follows:

(1) The funds should be disbursed in time to make sure that the project carries through successfully, through the form of prepaying pre-working capital, and then disbursing the project funds in stages.

(2) The afforestation facilities and equipments should be placed timely.

(3) The following issues needs to be solved: funds, training and technical support of plantation management, protection and tending in the operating period.

(4) The new forest road should link with the original rural roads.

(5) Overall arrangement of the project should be reasonable, such as the ratio of timber forest economic and forest, regional distribution, and so on.

(6) The tree species should be chosen based on local conditions. And the speed timber forest should be considered as much as possible on the basis of the principle that approaching to different lands and different trees.

(7) Take care of the high-voltage or low-voltage power lines during project operations to avoid adverse impact after the trees survived.

(8) They expect that the project can be implemented as soon as possible in order to improve farming conditions. The spring plowing has been threatened by the sandstorms for there are no shelter forest around farmlands and villages.

5.2.4 Feedback of Questionnaire

The results of this questionnaire are shown in Table 5-2. The major proposals of the public as follows:

(1) 98.34% of the publics consider that this project will have a positive impact on the ecological environment.

(2) The project areas locate in sand area, and there is no ecological barrier around. Therefore, the implementation of the project will achieve far-reaching ecological benefits.

(3) 95.02% of the publics think that this project, if implemented, will have a positive impact on their employment and income and improve their standard of living.

(4) Respectively 96.27% and 96.68% of the publics think that the project will not damage rights of the local minorities and women, and on the contrary they will get paid through labor thus improving the quality of their life and social status.

(5) The survey shows that 99.59% of the people agree with the project and 0.41% of the public don't concern about the project, 98.76% of the public hope that the project should be implemented as soon as possible and the others propose to postpone the construction of the project. There is no objection to the implementation of this project in the survey, and the suggestion of postponing means that before the implementation the government, project management department and other relative staffs should do all preparatory work more fully.

Table 5-2 Results of Consultation Questionnaire

Main issues	Categories	Number	Percentage (%)
1. How much do you understand this afforestation project?	Know	188	78.01
	Partly know	47	19.50

	Do not know	6	2.49
2. How do you know the afforestation project?	Notice and publicity	183	75.93
	Documents of forestry executive departments	52	21.58
	Other channels	6	2.49
3. What's the level of your understanding about the local ecological environment quality?	Know	194	80.50
	Partly know	46	19.09
	Do not know	1	0.41
4. What impact do you think this project will bring to the local ecological environment?	Advantage	237	98.34
	No impact	4	1.66
	Disadvantage	0	0.00
5. What impact do you think this project will bring to living environment and quality of the surrounding residents?	Advantage	230	95.44
	No impact	6	2.49
	Disadvantage	0	0.00
6. Do you think the project will increase local employment opportunities and income?	Increase	229	95.02
	No impact	7	2.90
	Decrease	0	0.00
7. Do you think the project will damage rights and interests of minority?	Will	6	2.49
	Will not	232	96.27
	Do not know	3	1.24
8. Do you think the project will damage rights and interests of women?	Will	3	1.24
	Will not	233	96.68
	Do not know	5	2.07
9. What is your attitude to this afforestation project?	Approve	240	99.59
	Disapprove	0	0.00
	Does not matter	1	0.41
10. Your general observations and recommendations.	Immediately implement	238	98.76
	Postpone	3	1.24
	Not implement	0	0.00

5.2.5 Feedback of Experts

ESIA Group has consulted the experts and technologists at all levels of forestry departments, EPA, universities, forestry research institution, ecology, environmental science, water resources and sociology and so on. They put forward many constructive proposals as follows:

(1)The afforestation project should be included in the forestry development planning of IMAR. Implementation and management of the carbon sequestration afforestation

project with EIB loans will play a great role in the comprehensive development of forestry in IMAR. Meanwhile, we should strengthen environmental protection management. The experts approve the afforestation project if the negative impact on the ecological environment and the society has been minimized.

(2) Tree species should have a reasonable proportion in comprehensive forestry development. Single species with large-scale and plot-connecting forest should be prevented. More attention should be paid to the protection of biodiversity and the creation of ecological landscape of the plantation.

(3) The method used in construction should be scientific. Full reclamation in soil preparation and large-scale mechanized soil preparation should be prohibited. The issue of restoration of forest undergrowth vegetation should be considered. Water and soil conservation in the project areas should be paid attention.

(4) The forest warrants issued should be given emphasis to. Property rights of the plantation should be clear. Ecological subsidies of forestry should increase.

(5) More active propaganda on environment protection should be organized. Pesticides utilization should be avoided as possible. Environmental-friendly fertilizers should be promoted.

(6) The issues concerned by farmers about the prepaid funds, stage funds, the construction of roads, power lines and other aspect should be considered. Financial and technical support should be provided to the farmers on plantation management, protection and tending. And the infrastructure should be placed synchronously.

(7) Establish a mature project management plan to avoid social risk and conflict in the selection of plantation sites and the farmers to participate in.

(8) The interests of vulnerable groups, the safety and health of workers should be considered in the implementation of the project.

5.2.6 Feedback of Farmers

In the course of the public consultation, ESIA team visited some typical farmers and

their families, and solicited their views and suggestions of the project .Their wishes about the project summarized as follows:

- (1) The policy should be stabilized. The interests of the farmers should be taken into account.
- (2)The governments should give technical support to farmers about plantation management and other aspects related.
- (3) Local farmers, forest farmer and herdsman should be employed as many as possible during implementing of the project.
- (4) The project should be implemented as soon as possible.

5.3 Conclusion of Consultation Processes

The above analyses show that the public care much about the construction of this project. The overwhelming majorities of individuals support the project, and expect it could be implemented as soon as possible. Local residents universally argued that the project can improve the living environment and economic conditions, and they can accept the adverse effects in the construction period. The overall conclusion of this consultation process is that this project can increase forest vegetation area of IMAR, improve the ecological environment and provide local residents employment opportunities and income, while the residents in project areas can get technical guidance and training, and improve their skills of planting and forestry management and protection.

6 Analyses of Alternatives

6.1 Introduction

Land utilization and operation of environmental protection in this project comply with correlative rules of the “*Forestry Law of the People’s Republic of China*”, the “*Environmental Protection Law of the People’s Republic of China*” and the “*Law of the People’s Republic of Soil and Water Conservation*”. The afforestation site has been non-forest wasteland with low productivity since 1989, which has degenerated or is degenerating, and has been programmed as land suitable for afforestation in the General Land Use Planning of Inner Mongolia Autonomous Region and county, banner, and district level people’s government. The land in the project areas complies with not only the request of forestry carbon sequestration, but also the development plan of local government, so it could be used for CDM afforestation.

No alternative scheme was given in the feasibility study report, so the comparison was drawn only between the project and no-project (‘do-nothing’ alternative) in this chapter. At first, the intensity and extent of the impact to the physical environment and social economy from the project or no-project were compared. And then the evaluation conclusion was given, and the rationality of the implementing scheme was analyzed. At last, feasibility of the project was summarized.

6.2 ‘Do-Nothing’ Alternative Analyses

The comparison between the effects of nature, ecological environment, society, economy and culture from two options of this project and ‘do-nothing’ project is listed in Table 6-1.

The comparison of impact on physical and ecological environment and social economic of the project or no-project is shown in Table 6-1. It is found that there are more advantages than disadvantages for environment and society of the project. Through considering comprehensively, this project is more reasonable and feasible than ‘do-nothing’ project.

Table 6-1 Comparison of Environmental and Social Impact with / without the Project

Impact		With project	Without project
Environ- mental impact	Direct	<p>1. Positive effects: increase forest resources and forest coverage in project areas, windbreak and sand fixation, improve ecological and landscape environment, improve the biodiversity, protect the farmland.</p> <p>2. Adverse effects: improper afforestation might cause ecological effects and risk; soil loss, fugitive dust, pest disasters in planting date and so on. Scientific afforestation techniques and logical environmental protection measures can be used to reduce the impact above.</p>	<p>1. No management measures, wasteland can easily encounter ecological problems of soil and water loss and land degradation etc.</p> <p>2. Dunes and bare land in this project have no ability to resist sandstorm damage.</p> <p>3. Environment is fragile, vegetation destroyed, and biodiversity will be threatened.</p> <p>4. There is no ecological protective barrier in project areas, so management of the farmland will be threatened and landscape is poor.</p>
	Indirect	<p>1. Supply for forestry products of lignum and fodder will increase, natural and ecological forest will be protected from destroying availably, and the ecological environment will be improve and protect indirectly.</p> <p>2. Form the forest environment, enhance the capacity of water conservation, and improve human settlements and life quality in project areas.</p> <p>3. Increase habitat of wildlife, form the biological corridor, be in favour of biodiversity protection.</p>	<p>1. Requirement of lignum is increasing by development of society and economy, natural forest and ecological forest will be destroyed at different degree, forest in nature reserve and biodiversity will be threatened.</p> <p>2. Lack of vegetation cover, land desertification, might cause soil erosion, animals' migration or disappearance, agricultural crops less productive, it can even cause new ecological disaster.</p>
	Comprehensive	<p>Adopt scientific and logical afforestation technology and management scheme, forest coverage will be increased and ecology and landscape will be improved after implementing the project. But there also has risks of negative influence to ecological environment if the design and construction methods are</p>	<p>Wasteland can't get virescence, and desertification can't be controlled. Finally, reduction of the vegetation coverage, aggravation of water and soil loss, soil desertification, deterioration of ecological environment, all of these will indirectly cause</p>

		improper.	poverty of local residents.
Social impact	Employment opportunities	Need labour of 1.772 million man-days, namely cumulative income of 106.32 million Yuan for local residents, with 14.88 million Yuan of that in Hohhot project areas, 41.58 million Yuan in Baotou, 31.02 million Yuan in Tongliao and 18.84 million Yuan in Bayannaer.	Local peasants mainly live on agriculture and animal husbandry, high rate of reclamation but lower productivity, graze form is always uncontrolled grazing, fewer sources for other employment income.
	Family income	1. Farmers as seasonal workers can get wages. 2. Forest farmers who contract natural forest can get profit besides pay loan.	Farmers still live on agriculture and animal husbandry mainly, with fewer sources from other employment income, standard of farmers living won't be changed, and especially the poor farmers lose a profitable chance.
	Professional skills	Training before the project, improve the farmers' skills on forest planting and plantation management.	Without instructor, farmers' skills of forestry are inferior.
	Poverty population	Provide employment opportunity and skill training for some poor people, increase their income, and reduce their burden of daily life.	No capital, lack of skill on forestry and lower income. In addition, living condition of the poor can not be changed.
	Women	Provide employment opportunity, help to lighten women' family and economic burden, improve conditions of public facilities in project areas, create conditions for women to work on livestock production, heighten their status in families.	Some women bear much economic pressure, especially women in poor families; the sexism exists on some women because of the influence from traditional ideas and family labour structure.
	Minority	Provide employment opportunity, increase income of minority persons; supply more opportunities for Minority and the Han to work, operate and manage together, promoting more exchange with each other.	Maintaining status quo, lack of opportunities from this project for increasing income, forestry skill training and culture exchange.
	Economic benefit	Total budgetary income of this project on carbon sequestration:	Maintaining status quo, without income of carbon

	138.468 million Yuan; total profit: 1.618694 billion Yuan.	sequestration and forest products.
Recommended scheme	Recommended	Not recommended

6.3 Basic for the Selection of the Alternative Proposed For the Project Design

6.3.1 Selectivity Analyses of Afforestation in Project Areas

Selection principles of afforestation in this project:

- (1) According to the land requirement of the Carbon Sequestration afforestation Project, the plots of non-forest wasteland were selected before construction.
- (2) Suitable ecological position principle. Ensure that the plantation will not bring adverse effects to surrounding ecology survival.
- (3) Forest classification management principle. Choose different proper tree species for different site conditions.
- (4) Consider impact on the policy, traffic, society, economy, and environment and so on.

Through investigating, the afforestation site chosen in this project is all non-forest wasteland since 1989 (Annexed Map 12). According with principles above, the selection of afforestation is feasible and reasonable.

6.3.2 Selectivity Analyses of Afforestation Species

Selection principles of afforestation species in this project:

- (1) Consideration of ecological and economic social benefit. Tree species need to be of not only high biomass and carbon fixation quantity, but also in favor of conserving soil and water, windbreak and sand fixation, and it is necessary to bring economy income to local farmers.
- (2) Tree species should be high survival rate, easy to plant, tolerant of drought,

resistance to wind erosion and have strong ability for sand burial.

(3) Adapting different lands, different trees and different provenances. Using the fast-growing native tree species to be the main tree species, and ensure the source of forestry seedling.

(4) The local peasants' (forest and grazing peasants) will should be respected, and forest products should have good market prospect.

Considering the above principles comprehensively, 17 kinds of tree species are chosen in this project, the total afforestation area is 31805.7 ha; afforestation of various tree species can avoid the singleness of tree species. The detailed scales of afforestation of tree species are shown in Figure 3-1.

6.3.3 Selectivity Analyses of Afforestation Modes

Selection of afforestation modes actually is the design on techniques scheme of afforestation. It includes selection of tree species and woodland, soil preparing mode, density, field planting, maintenance, management and fertilization. The selection of woodland and tree species has been analyzed foregoing. While in this section, comparisons of other technical design items and traditional afforestation modes are drawn and analyzed, and the results of potential environmental impact analyses are listed in Table 6-2.

6.3.4 Feasibility of the Implementing Scheme

Feasibility analyses of the implementing scheme focuses on policy condition, technology condition, infrastructure condition, carbon sequestration requirement in the project areas and the successful precedents. The details are listed in Table 6-3.

6.4 Conclusion

The EIB loans CDMAP has been calculated scientifically and prudently. At present, ecological environment of most banners, counties, districts and stations of the project is frail, while social economy is underdeveloped, agriculture is high rate of

reclamation but lower productivity, graze is always uncontrolled, and ecological environment in this area is hard to renew and maintain itself, and tend to getting worse and worse. With the project implementation, scientific and logical afforestation technology and management scheme will be adopted, and it will be helpful to improve the ecological environment, the living environment and the quality of life. The project also supplies a great deal of employment opportunities for the farmers to increase their income and promote economy development of project area. At the same time, traffic and other infrastructures will be improved through project construction. In conclusion, the results showed that there are more advantages than disadvantages for physical, ecological environment, society and economy, the project and the schemes are all feasible and reasonable.

Table 6-2 Comparison of Environmental Impact of Afforestation Modes

Environmental impact	Operation measures	Afforestation modes of this project	Traditional afforestation modes
Ecological environmental impact	Site preparing mode	Pit soil preparation; reserve the grass zone, reduce the broken ground area to 10-25% as much as possible, and adopt effective water conservation measures.	Full reclamation, barred soil preparation, break ground area is 30-100%, vegetation will be destroyed completely or partially, soil erosion is serious.
	Field planting	Use rate of the first grade seedlings is higher, make sure to tear the nutrition bags and keep nutrient soil tight, survival rate is high, seedlings grow rapidly, crown closure is early, be advantageous to water and soil conservation.	Use rate of the first grade seedlings is lower, the nutrition bags is not tore strictly or keep nutrient soil loose, survival rate is not high, seedlings grow slowly, crown closure is late, go against water and soil conservation.
	Maintenance and management	Use patch or strip weeding methods which are help for water and soil conservation and biodiversity protection.	Use whole weeding methods, go against water and soil conservation and biodiversity protection.

	Fertilization	Farmyard manure must be fertilized enough as base fertilizer when plant on sand wasteland. It will be helpful to increase the organic matter content, improve soil physical and chemical properties, and improve the forest growth conditions. The farmyard manure is fertilized on every plant up to 8 kg. After the first two years, the quantity of compound fertilizer of every plant decreases to 300g.	Fertilization lack pertinence, farmyard manure is not commonly used, chemical fertilizer is abused, crown closure is late, go against water and soil conservation, water sources will be polluted, and soil fertility will be destroyed by chemical fertilizer.
	Comprehensive evaluation	Select tree species base on the site condition, provide a detailed design of ground clearance, soil preparation, planting, tending (weeding, scarification, fertilization), forest logging time and environmental protection measures, according to design construction strictly. Based mainly on mixed forests, reserve the grass zone, reduce the impacts of biodiversity. Soil erosion is decreased at the same time; make lowest negative impact on ecological environment from the project.	Full reclamation soil preparation will appear because of the illogical afforestation design; density is bigger, no fertilization or fertilize unreasonable, planting method is coarse, forests are in poor growth. The undergrowth plants are inhibited because of the big density, biodiversity and biomass decrease obviously; there will be no grass under trees at last; it goes against water and soil conservation and biodiversity protection, big threat to ecological environment.
Recommended scheme		Recommended	Not recommended

Table 6-3 Feasibility Analyses of the Implementing Scheme

Basic factors	Feasibility analyses of factors
Afforestation policy and mechanical conditions are better in project area	<p>(1) The economy of 9 blocks in this project focuses mainly on synthetical development of agriculture, animal husbandry, and forestry.</p> <p>(2) Forestry organizations in this project area are perfect: there are perfect forestry management and service organizations in every banner, county, and district, forestry workstations are set in every village, and forest pests' dispensaries and forest resources management stations are set specially.</p> <p>(1) Prohibiting graze policy are carried out in the forest of project areas, government and publics all pay attention to ecology, and the consciousness for protecting forest and carbon sequestration afforestation is high.</p>
Sufficient	(1) On resource supply, 6 major forest projects are developed and several seeding

resources, mature technology, and great repayment capability	<p>projects are built, which can provide abundance seeds for the project.</p> <p>(2) Forestry workstations, forest pests' dispensaries, forest fire management, seeding stations are all have strong technical capacity, have accumulated abundance technology for afforestation, and have trained a large number of cadres on technical management and base technicians of afforestation.</p> <p>(3) On selection of tree species and production, tree species selected in this project are all local species which are fast-growing, high yield and steady in practice, technology of afforestation and forestry exploitation are both mature. Supply and demand gap of forest production is big, the market is vast, and market risk has been thought over adequately, which could ensure the steady income and repayment capability.</p>
Good infrastructure condition	<p>Infrastructure condition is good; it's convenient to pick, transport and sell the production; communication condition is perfect; mobile phones spread all over the county; electricity and heating power are provided adequately.</p>
Comply with the requirement of carbon sequestration	<p>9 blocks in 4 cities of the project areas are all non-forest wasteland since 1989.</p>
Reference of the successful precedents	<p>(1) In 2002, Japan Bank for International Cooperation (JBIC) ecological environment regulation project of IMAR was started into operation.</p> <p>(2) In 2005, Italy loans 8 national forest farms in Aohan Banner of Chifeng City to the project of carbon sequestration afforestation.</p> <p>Implementation of projects above has accumulated much mature experience for this project.</p>

7 Analyses of Environmental Impact and Proposed Mitigation Measures

7.1 Environmental Impacts Identification of the Project

The afforestation project will influence the environment during implementation and operation phases. Identification of the potential environmental impacts is screened according to the below items:

- (1) Professionally field investigations and previous experiences from experts on environment, ecology and forestry of the project ESIA group;
- (2) Conclusions of feasibility study on this afforestation project;
- (3) Terms of Reference (TOR) Environmental and Social Impact Assessment of EIB loan CDM afforestation project;
- (4) Some successful experiences from international financial organization of the WB and ADB Loan projects.

Environmental factors and influence behaviors of different implementation phases are compared and analyzed, to elicit degree of the impacts on environment from activities in different phases of the project. The important environmental impact links are screened to discuss emphatically, and relevant mitigation measures are given at last. The detailed contents are shown in Table 7-1.

In Table 7-1, it can be observed that when the project is implemented, weighting of positive impact is 24 while that of adverse impact is 19. So there are more advantages than disadvantages for environment implementing of this project, what is mainly shown in improving ecological environment systematically. Adverse impacts of the project are mainly the soil erosion problems caused during the construction stage. But these problems are all temporary, which will be solved as accomplishment of the implementation phase, and once the plantation is forming, it will be in favor of local soil and water conservation.

Table 7-1 Potential Environmental Impacts Identification of the Project

Environmental factors		Impact sources		Potential environmental profits and losses		Mitigation measures		Impact degree	
		Implementation phase	Operation phase	Implementation phase	Operation phase	Implementation phase	Operation phase	Implementation phase	Operation phase
Physical environment	Water environment	Application of Pesticides and fertilizers in tending stage.	Application of Pesticides and fertilizers in protective stage.	Regional water contamination and eutrophication will occur if they are improperly used.	The same as implementation phase.	Establish perfect pests monitoring and prevention system, use biological methods to reduce the use of pesticides; handle the casings of pesticide and fertilizer appropriately.	The same as implementation phase.	-1	-1
	Air environment	Dust produced in forest road construction.	New plantation and under forest vegetation.	Construction in windy days and forest road dust will threaten the health of inhabitants.	Vegetation will increase and environmental quality will be improved in operation phase.	Build forest road combined with county road to reduce breaking soil, avoid working in windy days, renewed vegetation after construction as soon as possible.		+1	+2
	Acoustic environment	Forest road construction machines; transport vehicle.	Transport vehicle.	Noise in implementation phase is temporary; noise from transport will not be considered relative to the background.	Noise from transport will not be calculated in comparison to the background value.	Keep the selected road lines away from sensitive area, night construction is forbidden.		-1	None
	Soil environment	Application of Pesticides and fertilizers in tending stage.	Application of Pesticides and fertilizers protective in stage.	The residues of the pesticides and fertilizers in soil.	The same as implementation phase.	Apply organic and farmyard fertilizers reasonably, handle the casings of pesticide and fertilizer appropriately.	The same as implementation phase.	-1	-1
	Solid waste	Waste residues of	Domestic	Sand roads are built	No new	Employ local farmers,	The same as	None	None

		the road construction, domestic wastes of workers.	wastes of workers	without residue; no new population and domestic wastes in the project areas.	population and domestic wastes in the project areas.	Herdsman, forest farmers and no population increase of the project areas.	implementation phase.		
Ecological environment	Vegetation	Human activities of soil preparation, planting and tending stages, and road construction.	Forest growth and logging.	The afforestation sites are all wastelands since 1989.	The plantation will increase the vegetation coverage, while logging will destroy vegetation.	Soil preparation is forbidden on large scale; original vegetation is protected in the wasteland.	Logging is forbidden on large scale, use methods of thinning; replant after logging timely; avoid destroying vegetation as possible.	-1	+2
	Animal	Human activities of soil preparation, planting and tending stages; road construction.	Human activities in protective stage.	The project areas are all far from natural forest and nature reserve; no wild animals appeared.	Habitats will be improved; animals and their natural enemies will increase.		Reduce human activities interference as possible.	None	+1
	Biodiversity	Human activities of implementation phase, selection of tree species.	Effects of plantation on original organisms.	Interference on wildlife from human activities of implementation phase.	Improve the habitats.	Reduce human activities interference on original habitat, reduce mechanical operation.	Selection of tree species on applying different approaches to different land, different trees and different provenances, with no biological invasion.	-1	+2
	Water resources	Tending stage	Forest growth in protective	Irrigation will increase water storage of the	Trees can conserve water,	Project areas are all less than 1 km from source, the existing	Take water saving measures,	-1	+1

			stage.	project areas, while waste will cause water resources supply unbalanced.	so it will be less need to irrigate in protective stage.	rivers and electric mechanical wells can be used; take water saving measures to satisfy irrigation demand.	to reduce waste of water resources.		
Soil and water conservation	Stages of road construction, soil preparation, tending and scarification.			Soil erosion will occur without conservation measures during stages of road construction, soil preparation, weeding and scarification.	Trees could control and reduce soil erosion.	Adopt appropriate water and soil conservation measures on slope>5°, no afforestation on slope>35°, avoid road construction, soil preparation, weeding and scarification in windy and rainy days; use blocking and protecting equipment in windy and rainy days.	Avoid digging <i>Cistanche deserticola Ma.</i> in windy and rainy days; earth up after digging right now, to restore vegetation as possible.	-2	+3
Soil fertility	Tending stage.	Forest growth.		Land in project area is desertification barrens, soil fertility can be improved with proper fertilization and irrigation, while superfluous fertilization and irrigation will cause salinization.	The litter can improve soil fertility, the roots can fix nitrogen.	Fertilizing and irrigating reasonably.		None	+2
Ecosystem	Human activities of the project construction.	The whole stage of operation.		interferences on ecosystem from human activities of implementation phase	Biodiversity will increase, ecosystem will become complicated, build ecological barrier and regulate climate.	Use environmental protection measures to reduce interference on ecosystem from activities of implementation phase.	Comply with supervision plan strictly, to protect and improve ecosystem function.	-1	+3

	Ecological landscape	Human activities of the project construction.	Forest growth.	Break ground in forest road construction and soil preparation process.	Turn wasteland to forest, ecological landscape will be improved.	Reduce destroying of landscape from human activities as possible	Reduce human activities interference as possible.	-1	+3
Environment sensitive target	Nature reserve	Human activities of the project construction.		There is no natural forest, nature reserve and ecological forest in the project area.	Construction of plantation will reduce unlawful felling natural forest unlawful as shortage of resources.			None	+1
	Precious wildlife	Human activities of the project construction.		No precious wildlife in the project area.	Supply habitat for migrated wild animals.			None	+1
Land occupation	Temporary land occupation	Construction land use.		Cause provisional vegetation destruction and soil erosion.		Avoid construction in windy and rainy days, and restore vegetation as soon as possible		-1	None
	Permanent land occupation	Forest roads, enclosures.	Afforestation land	No farmland will be occupied.	Improve the traffic condition and ecological environment, build ecological barrier.	Establish legal, practical and fair land use, forest contract and management system.	Establish forest management and protection plan, and pest control plan.	-1	+3
Risk	Diseases and insect pests	Improper management or natural disasters	The same as implementation phase.	it will bring enormous losses once it is occurred	The same as implementation phase.	Prevention first, and establish forest pest management plan.	The same as implementation phase.	-1	-1
	Fire disaster	Improper management or	The same as implementation	it will bring enormous losses once it is	The same as implementation	Prevention first, establish fire preventing and controlling	The same as implementation	-1	-1

		natural disasters	n phase	occurred	phase.	plan.	phase.		
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Note:

3- significant impact; 2- moderate impact; 1- slight impact; “+”-positive impact; “-”- adverse impact.

7.2 Environmental Impact during Implementation Phase and Proposed Mitigation Measures

7.2.1 Impacts on Environment Caused by Site Selection and Proposed Mitigation Measures

7.2.1.1 Environmental Impacts of Land Occupation and Proposed Mitigation Measures

The main negative impacts on the environment of land occupation of the woodland are shown as follows: for example, large scale afforestation at a time in certain region, will bring disturbance to environment at large scope during the implementation phase, and induce change of ecological environment in large square after completing the project, which will endanger the biodiversity and ecosystem. In addition, soil is disturbed at large scope during the implementation phase, inducing damage to vegetation, soil erosion and other negative effects, which are difficult to restore in short-period.

The detailed data of occupied land by the project are shown in Table 7-2. The total land areas shown in Table 7-2 are the total area of banner, county, or district where the project locates in, except desert control area of Bayannaer City. It is obvious that the proportion of afforestation accounting to total area of located banner, county or region is very small. Moreover, the land occupied is wasteland without forests. The local biodiversity, ecosystem and ecological landscape will suffer little impact. The disturbed vegetation in implementation phase could be restored in short-period, and effective water conservation measures should be adopted to alleviate the soil erosion problem during the implementation phase.

Table 7-2 The Land Occupation Area of the Project

Project regions	Regional characteristic	Total area (ha)	Occupation area (ha)	Ratio of occupation to total region (%)	Ratio of occupation to total project (%)

Xincheng District, Hohhot	Soil erosion area in the upper and middle reaches of Yellow River	70000	1287.1	1.84	4.05
Saihan District, Hohhot		102500	117.4	0.11	0.36
Helin County, Hohhot		340100	830.0	0.24	2.61
Guyang County, Baotou		496000	15941.0	3.21	50.11
Tongliao City: (Keerqin Distract, Kezuohou Banner, Kezuozhong Banner and Zhalute Banner)	Keerqin sand area	4142600	9861.2	0.24	31.00
Desert Control Comprehensive Test Station, Bayannaer City	Wulanbuhe sand area	11066	3769.0	34.06	11.87
Total		5162266	31805.7	0.62	100.00

7.2.1.2 Impacts on Ecological Environment Caused by Site Selection

The impacts on the environment caused by the afforestation site selection lies in two main aspects:

(1) If the afforestation sites are selected inconsequential, for example in the area that is adjacent to the natural forest, nature reserve or ecological forest, it will affect possibly the habitat of wildlife or route way of its migration activities and disturb the biodiversity, nature and integrality of ecosystem. The afforestation plots of this project are mostly far from the natural forest, natures reserve or ecological forest. Xincheng district, the only plot adjacent to Daqingshan National Nature Reserve, will construct shelter forest only. It will improve the habitat of wildlife and not affect the biodiversity and ecosystem after the project completes.

(2) If the slope of the chosen afforestation site was more than 35°, it would cause severe soil erosion. Most plots of the afforestation were located in the region of the

low mountain or hilly. It was not suitable to plant trees in the slope of which was more than 35°. The slope of land between 5° and 35°, the soil preparation and planting process could lead to some extent soil erosion, so the mitigation measures should be taken to prevent soil erosion.

7.2.1.3 Proposed Mitigation Measures to Environmental Impacts of Site Selection

During the soil preparation process, the full reclamation of soil preparation and large area of mechanization soil preparation are forbidden. For the gentle slope (<15°), soil preparation is adopted the pit digging method, while fish scale pit for the slope (>15° and < 35°). Fish scale pit soil preparation is small pit digging partially, and the disturbed soil area only occupied the afforestation area 3-8%. And also, the fish scale pits homogeneous disperse with triangle disposition. The pits could store water, and there will be retaining ditch and embankment and other water conservation measures in the underside, which could prevent new soil erosion.

7.2.2 Impact on Environment Caused by Tree Species Selection and Proposed Mitigation Measures

If the plant species are selected unsuitable, biological invasion problem will occur. So the tree species selection is based on the principle of applying different approaches to different land and different trees. Furthermore, the selection should be not only high biomass and high amount of fixed carbon, but also be suitable to conserve water and soil, break wind and fix sand. In order to prevent the biological invasion problem, no foreign species will be introduced, and local species are the major selected ones in the project. For example, the selection of poplar, the 4 species of *poplar* such as Tongliao poplar, Zhelin No.4 poplar, Tonlin No.5 poplar and Baicheng poplar series in the Tongliao project region, *P. Popularis* in Guyang County, Baotou city, *P. opera* (*P. simonii*×*P. pyramidalis*) and *P. popularis* in Hohhot project region.

7.2.3 Impacts on Environment Caused by Afforestation Mode and Proposed Mitigation Measures

Great danger to environment will be brought if the unsuitable afforestation mode is selected, e.g. single species in large area will lead to the single structure of forest, narrowing of biodiversity and genetic gene. Then forest landscape and biodiversity will be affected, the mechanisms of pest and disease control will be weakened, and the occurrence of diseases and insect pests will increase.

Above all, several modes are adopted in this project. Mixed forest mode is adopted in Tongliao city, the rest regions were the mode of the small plot of pure forest and the whole patches mixed afforestation mode, and the detailed modes are shown in 7-3. Though the pure forest mode is adopted in the project, several tree species with several afforestation modes interval are adopted in every project regions, which could mix the whole afforestation region in mixed form. Every forest plots are all about 30 ha, and it could also reduce the risk of diseases and insect pests, improve the forest landscape, and increase the biodiversity.

Table 7-3 Afforestation Modes and Environmental Impact Analyses of the Project

Afforestation sites		Afforestation modes	Tree species	Scale of afforestation region (ha)	Remarks
Hohhot City	Xincheng District	Small patch with pure forest and Integrated patches mixed mode	I, II	I: 23.0 II: 14.0	III and IV are patches mixed, and mixed with I and II in block form. Single plot of afforestation area is less than 300 ha. So the environmental impact is slight.
	Saihan District, Helin County		I, V, VI, VII, VIII	I: 34.0 V: 100 VI: 26.0 VII: 14.0 VIII: 20.0	II and V are rows mixed form which is patches mixed mode with small patch pure forest. Single plot of afforestation area is less than 300 ha. So the environmental impact is slight.
Baotou City	Guyang County		I	666.0	X, XI and IX are rows mixed form which is patches mixed mode with I and IX, Single plot of afforestation area is less than 300 ha. So the environmental impact is slight.
			IX	3275.0	
Bayan-naoer City	Desert Control Comprehensive Test Station		XII	2769.0	XI and XIII is rows mixed form which is patches mixed mode with XII. Single plot of afforestation area is less than 300 ha. So the environmental impact is slight.

Note:

I, <i>poplar</i>	II, <i>Salix matsudana Koidz</i>	III, <i>Flos Caryophyllata</i>
IV, <i>Rosa xanthina Lindl.</i>	V, <i>Mongolian Scotch Pine (Pinus sylvestris var. mongolica Litv.)</i>	
VI, <i>Sophora japonica Linn</i>	VII, <i>Robinia pseudoacacia cv.idaho</i>	
VIII, <i>Catalpa ovata Don</i>	IX, <i>Caragana Korshinskii Kom.</i>	
X, <i>Ulmus pumila L.</i>	XI, <i>Elaeagnus angustifolius</i>	
XII, <i>Haloxylon ammodena Bunge</i>	XIII, <i>Tamarix chinensis Lour.</i>	

7.2.4 Impact on Environment of Soil Preparation and Planting, and Proposed Measures of Soil and Water Conservation

7.2.4.1 Impact on Environment Caused by Soil Preparation and Planting

Soil preparation before afforestation could improve the soil granular structure, increase the survival rate of plantation and promote tree growing and developing to obtain fast growing and high yield. There is relatively humid atmosphere in Tongliao city, and soil wind erosion is not obvious in winter for the freezing soil, but in the other regions, natural and ecological environment conditions are very poor, the soil preparation process will cause great damage to the vegetation and disturbance to the top soil layer. Unsuitable soil preparation will arise soil erosion easily, and water and soil loss, which lead to environmental deterioration and reduction of land productivity. Taking Hohhot, Baotou and Bayannaer City as examples, frequent and strong winds in spring and winter, land surface is disturbed and bared for a long time, which could possibly cause soil desertification. During the landfill of the seeding process, the vegetation is likely to be destroyed on the land surface, and top soil layer would be disturbed, which could cause some soil erosion.

The prediction results of the newly-added soil erosion are shown in 7-4. From the Table 7-4, the soil preparation methods of fish scale pits and pits adopted in this project, will disturb the soil slightly, and the proportion of the area of disturbance soil accounting to the total area of the project will be only 5.32%. Soil about 10670000 m³ will be disturbed during the soil preparation, while about 49549.35 ton would

accumulate of the newly-added soil erosion in the implementation phase. It is necessary to adopt effective mitigation measures to prevent soil erosion for the negative effects of soil preparation.

Table 7-4 The Soil Disturbed Condition and Estimation of Amount of Newly-added Soil Erosion during the Soil Preparation

Project sites	Ratio of disturbed to total project area (%)	Total bulk of digging soil (m ³)	Soil windy erosion (Ton)	Soil water erosion (Ton)	Total soil erosion (Ton)
Hohhot City	5.88	783169.85	2639.45	1759.64	4399.09
Guyang County	5.44	5288576.40	15614.78	10409.85	26024.63
Tongliao City	5.79	4023342.81	9209.28	6139.52	15348.80
Bayannaer City	3.34	574227.50	2266.10	1510.73	3776.83
Total	5.32	10669316.56	29729.61	19819.74	49549.35

7.2.4.2 Soil and Water Conservation Measures during the Site Preparation and Planting Stage

In autumn and a year before the afforestation is selected as the soil preparation time. In order to increase the survival rate of afforestation, planting starts from the spring or rainy season of the second year that could make backfill soil be aging and full of water content. Once the soil is thaw in spring, planting should be done right now. It should adopt contour planting in the hilly area, and wheat straw or clay sand-barrier should be set in front of windward slope of the afforestation site, which will mitigate the soil erosion at certain extent.

It is necessary to pay much attention to soil preparation, planting and other steps. And above steps must be done avoiding strong wind and rainy days. The soil preparation methods of fish scale pits and pits will reduce the destroyed land area. Soil preparation and planting process may cause negative impacts on environment which is only in short-term. But after the afforestation, the vegetation coverage will increase and the soil erosion in project region will reduce. In a long run, the afforestation can improve the regional ecological condition, and be favor to establish ecological

protective screen for soil and water conservation.

7.2.5 Impacts on Environment of Plantation Tending and Proposed Mitigation Measures

Plantation tending includes loosening soil, weeding, irrigation, stumping (*Caragana Korshinskii Kom*), insect pest prevention as well as protection and management of the plantation.

7.2.5.1 Impacts on Environment of Irrigation and Proposed Mitigation Measures

Irrigation will increase the water demand, and will cause the imbalance of water utilization. And there will be impact on the water resource utilization.

The water resource is lack in project regions with an annual rainfall below 400mm, so the planting must be irrigated to ensure the survival rate of the seedling at the beginning of the afforestation. In order to make irrigation convenient during the tending period, the water resources for afforestation are selected near rivers or electromechanical wells within 1 km. The predicted water consumption in each project site is shown in Table 7-5.

The irrigation will lead to competition for water consumption of the daily life, industrial and agricultural production. Therefore, the plantation must be irrigated by water-saving measures, and the exploitation of groundwater should be avoided. In order to save water, pit-irrigation should be used, and after irrigation the watered pits should be covered with soil to decrease evaporation. The irrigation should avoid the peak of water demand.

7.2.5.2 Impacts on Environment of Pesticide and Fertilizer Application and Proposed Mitigation Measures

In order to control plant diseases and insect pests in forests, the application of pesticides are inevitable, and the misuse of pesticide will cause adverse environmental impacts. The application of pesticides can kill the natural predator of harmful insects, and cause biodiversity decline and the unbalance of species. If misused pesticides, the pesticide can pollute water supplies and soil, and endanger the health of the residents, livestock, crops, and wild animals, directly or indirectly. And the pesticide spraying equipment

will contaminate the water and soil if not cleaned correctly.

Excessive uses of inorganic fertilizers will destroy the physical and chemical properties of soil, and it can result in soil hardening, decrease soil fertility sustaining ability, finally lead to soil degradation. In the meantime, the nutritive salts from inorganic fertilizers will flow into the water bodies by rainfall and irrigation, and cause eutrophication of water.

The possible plant diseases and insect pests and the control measures of the project are shown in Table 7-6.

During the implementation and operation phase of the project, the application of pesticides and fertilizers should follow the “*Environmental Protection Guidelines for Plantation Establishment and Management*” and “*Plantation Integrated Pest Management Plan*” (PIPM) strictly. Plant diseases and insect pests control should use precaution and microbiological processes. The 1st species of first and second category of pesticides are forbidden to use. The first year of the planting farmyard manure will be applied and then the organic fertilizers will be used after. These will improve the physical and chemical properties of soil, and cause slight adverse environmental impact. Besides, the packing receptacle of the pesticides and fertilizers should be collected and treated centralized, and also the vessel must be forbidden to wash in the river or lake.

Table 7-5 Water Consumption of the Project

Project region	Years	Planting area (ha)	Irrigated area (ha)	Water consumption (ton/ (ha · year))	Water consumption (ton/year)	Total water resources (×10 ⁴ ton)	Proportion to total water resources (‰)	Remarks
Hohhot City	2009	223.4	223.4	150 ^a (57.4 ^b) 50 ^c (166 ^d)	16900	172359	0.0098	In Xincheng District, seedling with dipping slurry will be used and no irrigation. In Saihan District and Helin County the seedling will be irrigated once a year at the first 3 years and then no irrigation.
	2010	226	449.4	150 ^a (117.4 ^b) 50 ^c (332 ^d)	34200	172359	0.0198	
	2011	166	615.4	150 ^a (117.4 ^b) 50 ^c (498 ^d)	42500	172359	0.0247	
	2012	166	558	150 ^a (60 ^b) 50 ^c (498 ^d)	33900	172359	0.0197	
	2013	166	498	50 ^c	24900	172359	0.0144	
	2014	0	332	50 ^c	16700	172359	0.0096	
	2015	0	166	50 ^c	8300	172359	0.0048	
Baotou City	2009	3,188.2	3,188.2	45	143500	13812	1.0387	The seedling will be irrigated once a year at the first 3 years and then no irrigation.
	2010	3,188.2	6,376.4	45	286900	13812	2.0775	
	2011	3,188.2	9,564.6	45	430400	13812	3.1162	
	2012	3,188.2	9,564.6	45	430400	13812	3.1162	
	2013	3,188.2	9,564.6	45	430400	13812	3.1162	
	2014	0	6,376.4	45	286900	13812	2.0775	
	2015	0	3,188.2	45	143500	13812	1.0387	
Tongliao City	2009	1,972.2	1,972.2	300	591700	325800	0.1822	The seedling will be irrigated once a year at the first 3 years and then no irrigation.
	2010	1,972.2	3,944.4	300	1183300	325800	0.3643	
	2011	1,972.2	5,916.6	300	1775000	325800	0.5465	
	2012	1972.2	5916.6	300	1775000	325800	0.5465	
	2013	1972.2	5916.6	300	1775000	325800	0.5465	
	2014	0	3944.4	300	1183300	325800	0.3643	
	2015	0	1972.2	300	591700	325800	0.1822	

Bayannaer City	2009	753.8	753.8	90	67800	-	-	The seedling will be irrigated only once at the first year of planning by the Yellow River with current irrigation system.
	2010	753.8	753.8	90	67800	-	-	
	2011	753.8	753.8	90	67800	-	-	
	2012	753.8	753.8	90	67800	-	-	
	2013	753.8	753.8	90	67800	-	-	

Note:

a- The Water Consumption per hectare in Saihan District; b- Irrigated Area in Saihan District;
c- The Water Consumption per hectare in Helin County; d- Irrigated Area in Helin County.

Table 7-6 Diseases and Pests Control of the Project

Disease and pests	Preventing and controlling by pesticides	Proposed control measures
Poplar leaf spot: scab, brown spot and spot blight.	In the early stage of disease, spray 300-500 times diluent liquid of 65% Dithane, 40% Asomate, 500-1,000 times diluent liquid of 50% Tuzet or 50-800 times diluent liquid of 50% thiophanate methyl or 0.5~1% Bordeaux mixture to protect the leaf and prevent the spread of the disease.	Remove overwintering diseased leaves; control density of seedlings, loosen soil and remove weed timely, make ventilation and penetrating light good; apply mixed fertilizer and avoid excessive using of nitrogen fertilizer to promote seedling growth and enhance the resistance ability.
Poplar rot disease	Apply Dimethoate, Phosphamidon and accothion mixing with some germicide such as Tuzet, Asamate, Dithane thiophanate etc. Formula is 0.5kg Phosphamidon + 0.5kg Dimethoate+0.5kg Tuzet+50~100kg water.	Control damage of forest trunk borers and defoliator of the poplars timely to improve growth and development and the resistance of trees to the insect pests; after 1-2 years of the field planting, brush the bole 2 times during the first and middle ten days of June; scrape the ill spot
Powdery mildew of saxaul	Apply 300 times diluent liquid of Bo-10 (a biological preparation) or 4,000 times diluent liquid of 25% Triadimefon.	Spray pesticides.

Russian olive psylla	Apply 2,000 times diluent liquid of Cypermethrin or 5,000 times diluent liquid of 0.9% Aifutin EC.	Spray pesticides of ultra low volume (ULV).
Rot disease of <i>Cistanche deserticola</i> Ma.	Germicide	Apply germicide to prevent the disease when the seedling is inoculated.
Insects pests of <i>Cistanche deserticola</i> Ma.	Apply 1000-1200 times diluent liquid of 40% Phoxin EC.	Spray pesticide to control.
<i>Parathrene tabaniformis</i> Rottenberg	Apply 20-30 times diluent liquid of 50% Phosphorus amine EC on the trunks; plug the bore hole with CS3 tampon; mix 1 part 2.5% Deltamethrin EC, 5-10 part yellow clay and adequate water into mud; spray 500-1,000 times diluent liquid of Dichlorvos on the trunks and branches.	Seek out the seedlings with pests during the tending; apply pesticides on the trunks in larval stage of the pests; plug the bore hole with insecticidal mud; puncture larvae with iron wire; remove the branches with pests; the forest with severe pest infestations should be changed to other tree species.

7.2.5.3 Impacts on Environment of Other Tending Process and Proposed Mitigation Measures

At the first three years of the planting, weeding and loosening soil will be carried through three times every year, which may cause new soil erosion with the disturbance of vegetation and soil. So loosening soil and weeding should be limited in the range of the hole for the seedling, and avoid the strong windy days.

In order to promote the development of *Caragana Korshinskii Kom*'s root system, enhance the germination, the first stumping will be done after three years of the planting, and then the periods will be five years. *Caragana Korshinskii Kom* will be seeded in Guyang County, and stumping will decrease vegetation on the ground and cause new desertification in a short time. With the vegetation decrease, the animal habitats will decrease, and then the biodiversity will be impacted. The area planted *Caragana Korshinskii Kom* can not be in a large scale. And stumping should be done in different times and patches when there's no gale.

7.2.6 Environmental Impacts of Forest Road Construction and Proposed Mitigation Measures

7.2.6.1 Engineering Situation of Forest Road Construction

In the project, 239.9 km of unpaved operation road and 18.8 km net fence will be constructed, which occupies less than 0.5% area of the total, and all the building sites are wasteland with no cultivated land.

7.2.6.2 Impacts on Environment of Forest Road Construction

The environmental impacts resulting from forest road construction are mainly as follows:

(1) Impacts from land occupation

Land occupation of forest road construction is composed of temporary occupation and permanent occupation. It will destroy the original vegetation on the ground and change the physical and ecological landscape. Permanent occupation includes the

occupied area of forest road and net fence, with the total area of 150 ha. Temporary land occupation consists of the places for equipment, tools and stonework when the construction is in process. The temporary land occupation is much less than the afforestation area, with the percentage of 0.5%, so it has few impacts on the environment. In addition, with the progress of afforestation, it will turn to advantageous effects.

(2) Impacts of soil erosion from forest road construction

The new soil erosion during implementation phase will mainly occur in the process of forest road and net fence construction. This will destroy the natural vegetation and original relevant stable ground surface inevitably. When the roadbed is started to excavate, loose slope at the side of road will be formed, which may induce soil erosion if no defending measures are adopted. However, this impact will disappear as the plantation growing. Furthermore, soil erosion can be kept within limits by the afforestation.

The situation of new soil erosion induced by the construction of forest road and net fence is shown in Table 7-7. It can be seen from Table 7-7 that 384.78 ha of the ground will be destroyed during the construction, and the total amount of new soil erosion will be 11543.4 ton. There are certain impacts on soil in the construction stage, so mitigation measures should be proposed.

Table 7-7 Estimation of New Soil Erosion Induced by the Construction of Forest Road and Net Fence

Project sites		Total impacted area during construction (ha)	Soil windy erosion (ton)	Soil water erosion (ton)	Total soil erosion (ton)
Hohhot City	Xincheng District	8	144	96	240
	Saihan District	0	0	0	0
	Helin County	38.38	690.84	460.56	1151.4
Baotou City	Guying County	0	0	0	0
Tongliao City	Keerqin District	35.36	636.48	424.32	1060.8
	Kezuozhong Banner	72.96	1313.28	875.52	2188.8

	Kezuohou Banner	74.72	1344.96	896.64	2241.6
	Zhalute Banner	72.8	1310.4	873.6	2184
Bayannaer City	Desert Control Comprehensive Test Station	90.4	1627.2	1084.8	2712
Total		384.78	6926.04	4617.36	11543.4

(3) Dust, noise and exhaust gas produced by construction machineries:

The project area locates in Inner Mongolia, where there's few ecological protective forest and the climate is usually dry. The forest road construction will destroyed original vegetation and make the ground bareness. Thus, the dust can easily emit to the air and the total density of suspended particle (TSP) will increase during the mechanical execution. In addition, construction machines will exhaust some off gas and make noise during working. Accordingly, the construction process will impact the environment in the project area when machines are in operation.

7.2.6.3 Proposed Mitigation Measures for Impacts of Forest Road Construction

The following mitigation measures will be applied to reduce the adverse impacts on environmental resulting from forest road construction:

- (1) Make full use of the existing roads. Try the best to construct forest road combined with the county road, along the fire line and compartment line as much as possible to reduce the loose slope.
- (2) Do not make constructions in windy or rainy days, or else use blocking equipment to protect bare land. After the construction, the vegetation should be recovered as soon as possible.
- (3) If new roads must be constructed additionally, it should be located away from countries, in order to avoid traversing trucks. If inevitable, the trucks should not traverse the county during the period of 22:00 at night to 6:00 in the morning. In addition, logos for speed limiting should be set near the countries for avoiding possible traffic accidents and dust emission, which may endanger safety and health of

public.

7.3 Environmental Impacts during Operation Phase and Proposed Mitigation Measures

7.3.1 Eco-Environmental Impacts during Operation Phase and Proposed Mitigation Measures

7.3.1.1 Vegetation Change and Impacts during Operation Period

(1) Evaluation index

Survival rate of trees and vegetation coverage rate are selected as typical indexes in this section for quantitatively analyzing and predicting the vegetation change before and after the afforestation.

(2) Analogy target

By using analogue Analyses method, the vegetation change during the operation is analyzed. The analogy targets are shown in Table 7-8.

Table 7-8 The Analogy Targets in the Project

	The Project	JBIC Inner Mongolia eco-environmental project in sandy area	Aohan Banner CDM afforestation project
Afforestation area (ha)	Helin: 830 Bayannaer: 3769 Tongliao: Keerqin: 1365.0 Kezuozhong: 2811.4 Kezuohou: 2880.0 Zhalute: 2804.8	Helin: 886700 Bayannaer: 5379500	Chifeng City: 2300
Site condition	Helin: hilly, Bayannaer: mobile dunes, Tongliao: immovable desert, semi- immovable desert or dune	Helin: hilly, slope Bayannaer: mobile dunes, immovable desert, semi- immovable desert or dune	Hilly, blown sand swamp, desert or dune
Afforestation mode	Helin: rows mixed and patches mixed Bayannaer: rows mixed and patches mixed	Helin: rows mixed Bayannaer: strips mixed	strips mixed

	Tongliao city: strips mixed		
Main species	Helin: I, II, III Bayannaer: IV, V, VI Tongliao: II, I, VII	Helin: VIII, IX, X, XI Bayannaer: II, XI, XIII	II, XIV
Conclusion	This project has some same afforestation areas with JBIC Inner Mongolia eco-environmental project in sandy area, with the locations of Helin County and Bayannaer City. They have similar natural environment and afforestation situations. In addition, Aohan Banner CDM afforestation project located at the south of Keerqin district, which has the same location, natural environment and afforestation situations with Tongliao City of this project. Thus, these two projects can be used as analogy targets for environmental impact Analyses in this report.		

Note:

- I, *Mongolian Scotch Pine (Pinus sylvestris var. mongolica Litv.)* II, *poplar*
 III, *Salix matsudana Koidz* IV, *Haloxylon ammodendron* V, *Elaeagnus angustifolius*
 VI, *Tamarix chinensis Lour* VII, *Ulmus pumila L.* VIII, *Pinus tabulaeformis Carr.*
 IX, *Elaeagnus angustifolius* X, *A.sibirica (L) Lam [prunus sibirica L]*
 XI, *Caragana Korshinskii Kom.* XIII, *Salix Mongolia* XIV, *Astragalus membranaceus*

(3) Percentage of wood survival and vegetation coverage of the analogy targets

74.13 ha of trees were planted in the spring of 2005 in Aohan Banner CDM afforestation project, and 2225.87 ha trees were planted in the autumn. In 2006, the percentage of survival arbor was monitored to be 93.6-94.3%, and that of shrub was 90.8-91%. The percentage of vegetation coverage would be supposed to increase for 0.36% after the project was finished.

By planting trees and grass, the JBIC Inner Mongolia eco-environmental project in sandy area would increase the percentage of vegetation coverage by 2.95%. In Helin County, the survival rate of arbor is more than 85%, and that of shrub is more than 70%.

According to the expression of experts of forestry bureau in Helin County, the area selected in this project is floodplain, better than the condition of area in the JBIC Inner Mongolia eco-environmental project in sandy area.

In summary, based on scientific management and successful former experiences, this

project can reach good effects: increasing the percentage of survival rate of afforestation and percentage of vegetation coverage rate, and improving the local eco-environment.

7.3.1.2 Animal Changes and Impacts during Operation Phase

The situation of animal change refers to the Helin County in the JBIC Inner Mongolia eco-environmental project in sandy area. The number and category of wild animals such as hare, sand grouse and lark were both investigated to increase obviously.

Meanwhile, in the JBIC Inner Mongolia eco-environmental project in sandy area, bird diversity indexes in the project area and the analogy area were 0.82 and 1.38, respectively. Accordingly, bird diversity will be increased with the increasing of vegetation coverage percentage.

The selection area in the project is wasteland without trees. Thus, favorable conditions will be built for wild animals for their habitats and activities in the project area. And so the number and category of animals will increase accordingly.

7.3.1.3 Eco-Environmental Impacts during Operation Phase

Eco-environment conditions will be improved obviously after the project is implemented:

(1) The forest area will increase 31805.7 ha, and the increasing area takes 0.6% of the total land area of the nine Banners, countries and districts. The percentage of vegetation coverage and the number and category of animals will increase obviously, which means the biodiversity will be increased.

(2) The forest can absorb and fix CO₂, and absorption and fixing amount of CO₂ will reach at 280200 tons per year by the net area of new forestry. It could be effective on preventing the global warming. Also, the forest can absorb smoke and dust, beauty and purify the environment. Finally, the region environment will be improved.

(3) Inner Mongolia is one of the most sandy desertification areas in China, with 52.61% of the desertification area and 35.16% of the sanded area. When the project is

achieved, the percentage of vegetation coverage will increase and meanwhile, the plantation will conserve soil and water. Calculation based on forest's soil conservation of 3,000 cubic meters per hectare and the percentage of soil immobility as 80%, the amount of sand immobility and soil conservation is 76.333 million cubic meters. It can be concluded that the project will effectively reduce soil erosion and desertification.

(4) After the project area close to the forest, the project areas can reduce windy erosion to crops as well as increase food and forage production. Supposing that a hectare of shelter forest will protect 5 ha of the farmland or pastures, so 159000 ha of farmland and pastures will be protected by the project after completion, and the rate of increase production will reach to 10 ~ 15%. Abundant shatter of forest each year fall down and synthesize with soil animals and microorganisms of soil nutrients circulatory system can increase soil fertility.

However, if the project is not managed well during the project operation phase, adverse effects as follows will impact the eco-environment:

(1) Timber logging will destroy the vegetation, scene and bird habitats; logging will destroy the underground vegetation and the habitats of some animals and insects.

(2) Stumping of *Caragana Korshinskii Kom* will decrease the vegetation on the ground, and may induce new desertification of land. So the biodiversity may be affected.

(3) There are two harvest time in a year for *Cistanche deserticola Ma*, with one in spring (from late March to late April) and one in Autumn (from October to November). After the harvest, the ground will be bare and unsmooth, and it will be easily eroded in gale weather.

(4) The land itself is sandy area. Appropriate fertilization and irrigation can improve the soil fertility. However, if the fertilization is excess, the soil will be sanitized. In addition, improper using of pesticides and fertilizers will pollute the soil environment.

7.3.1.4 Proposed Mitigation Measures of Eco-Environmental Impacts during Operation Phase

This project combined sand damage prevention and desertification prevention with climate warming mitigation. The eco-environment and natural scene will be obviously improved. In order to protect the biodiversity, balance the eco-system and prevent new soil erosion, following work will be done by this project:

- (1) Prevent excessive timber logging, and replant trees after logging. Do not destroy ground vegetation during the timber logging and transporting.
- (2) Avoid stumping *Caragana Korshinskii Kom* in large scale at one time. Stumping should be done in different times and patches and avoid great gale.
- (3) The digging of *Cistanche deserticola Ma.* should obey the principle of “harvest alternation, plant alternation, plant when harvest, more plant than harvest”. When *Cistanche deserticola Ma.* is dug out, the ground should be recovered as soon as possible. In addition, digging is prohibited when gale and rain comes.
- (4) Most of the trees in project area need not irrigation, so there will be no problem of the soil erosion caused by irrigation. The using of pesticides and fertilizers will accord to the same mitigation measures in section 7.2.4.2.

7.3.2 Environmental Impacts during Operation Phase and Proposed Mitigation Measures

7.3.2.1 Water Environmental Impacts during Operation Period and Proposed Mitigation Measures

Irrigation is supposed to have main impact on water environment during the project operation. The predicted water consumption of each project sites is shown in Table 7-4. However, irrigation is normally not in motion, as the trees grow steadily during the period of project operation and they themselves have the function of water conservation. Thus, the surface water resource is basically enough for irrigation, and the irrigation has little impact on underground water resource in this area.

The use of pesticides is another possible impact factor for water environment during the period of project operation. If the pesticides are not treated properly, the water environment would be possibly polluted (e.g. the cleaning process of pesticide container may increase the contamination of water). Thus, the containers of pesticides and chemical fertilizer should be properly treated.

7.3.2.2 Air Environmental Impacts during Operation Phase and Proposed Mitigation Measures

This project has advantageous affect to the atmospheric environment. The vegetation coverage in the large project area can make bare land recovered by green plants, and thus the fugitive dust from ground can be reduced effectively. Accordingly, the TSP content may be decreased significantly, and the local atmospheric environment is possibly improved.

The project may also have some adverse impacts on the atmospheric environment during the operation phase. For example, some dust on the ground can be floated into the air in dry and gale weather, so the work should not be done in gale weather. In addition, the transportation vehicles can pollute the air by their off-gas and by emission the dust on the road, and thus, the exhaust purifying device are suggested to be used on the transportation vehicles and the roads are suggested to be sand-gravel pavement. As the forest farms are sparsely populated, the anthropogenic impact on air environment in the project area is little.

7.3.2.3 Acoustic Environmental Impacts during Operation Phase and Proposed Mitigation Measures

The transportation of material and wood are the main process to produce the adverse impacts to acoustic environment. The involving project areas include the cities of Hohhot, Baotou, and Tongliao. However, as the working areas are normally sparsely populated, so the impact on air environment in the project area is little.

7.3.2.4 Solid Waste Environmental Impacts during Operation Phase and Proposed Mitigation Measures

The main solid waste in the project area is domestic waste produced by workers in forests. Accordingly, the project is suggested to be contracted to the villagers nearby, so that no additional population and solid waste would be produced in the project area.

7.4 Risk Assessment and Prevention Measures

7.4.1 Ecological Risk Assessment and Prevention Measures

The main ecological risk of the project is normally the biological invasion. However, as the tree species are all local ones, this problem does not exist in the project area.

7.4.2 Natural Risk Assessment and Prevention Measures

The project located in semi-arid and arid desert areas, with gale and sand all around, so the main natural risk is fire disaster and insect pests. The risk factors and risk degrees are showed in Table 7-9.

According to the natural risk Analyses, the following prevention measures should be adopted in this project.

(1) The areas of this project are deserts with good transport conditions, thus, new fireproof-roads are not need to be constructed. Based on the principle of protection first and prevention primary, reasonable plan for forest protection is constituted (shown in annex E), and active fire-prevention measures are adopted. When the project is planning, soil-isolation belt is planned to be constructed in every 300-400 ha afforestation site, and used for transportation and fire-prevention.

(2) The plantation integrated pest management plan is constituted (shown in annex F). The plan includes performing quarantine system strictly, forbidding tree seeds with diseases and insect pests, fully closing off epidemic situation and preventing from its spread, etc. The tree seeds should be registered before their using, and saplings would be produced and sold with the “production license”, the “examination certificate” and the “management license”. When the seeds with diseases and insect pests are found,

they would be destroyed at once. In addition, the plantation would be well managed and the natural enemy of diseases and pests would be well protected for the ecological balance. An early-warning system would be built to monitoring the diseases and insect pests in forest and preventing the pest disaster by the forest-protection department. When the diseases and insect pests occur, physical or chemical methods would be carried out by stages to control the development of diseases. Integrated and biological control would be promoted during diseases and insect pests' control.

Table 7-9 Identification of Risk Factors and Analyses of Risk Degrees

Risk factor	Risk analyses	Risk degree	Environmental risk
Fire disaster	<p>Basically, natural fire conditions cannot be reached in the project area. And anthropogenic fire is also hard to happen here because of the meagre population. In addition, broadleaved tree and shrub composed the main species in the forest, so the fire danger rating in the forest is low.</p> <p>Based on the historical conditions, the fire risk in forest and grassland can be divided into two stages. The spring fire season is from mid-March to mid-June, with the most frequent fire risk in April; the autumn fire season is from mid-September to mid-November, with the most frequent fire risk in October. The fire frequency in spring accounts for 75% of the whole in a year.</p> <p>However, weather factors such as high temperature, long term drought, strong gale may directly or indirectly induce the fire disaster. In addition, the forest fuel would increase after the project implemented, and so does the possibility of fire risk in the forest.</p>	low	low

Risk factor	Risk analyses	Risk degree	Environmental risk
Diseases and insect pests	<p>Leaf spot of popular tree usually happens in June to August, mainly caused by long time water accumulation or the great density of planted trees.</p> <p>Rot disease of popular tree is caused by some parasitic fungi via infecting the cuts on weak trees. This disease usually happens in mid to late March, and the strong trees are seldom infected.</p> <p>Powdery mildew of saxaul usually happens in July to August, and it hurts the shoot on trees.</p> <p>Rot disease of <i>Cistanche deserticola</i> Ma will be controlled by applying some fungicide at the inoculation time.</p> <p>Insect pests on <i>Cistanche deserticola</i> Ma are mainly scarab and grub, affecting the production and quality of <i>Cistanche deserticola</i> Ma.</p> <p>Rodent damage in Inner Mongolia is serious. The damaged area in the spring in 2007 reached 7.14 million ha.</p>	medium	low

8 Analyses of Social Impact and Proposed Mitigation Measures

8.1 Impacts on the Related Stakeholders and Mitigation Measures

8.1.1 Assessment Methods

ESIA team realized the major problems focused on by local related stakeholder, and obtained detailed information (Annex D) by means of public consultation, talking with local related stakeholder, expert consultation, sample surveys, and soliciting the local farmers' suggestion, including herdsman and forest farmers. Then, various potential risks of the project to society have been widely analyzed. In order to accommodate to local residents' needs, mitigation measures to the negative effects were established based on referred data above.

8.1.2 Analyses of the Impacts on the Related Stakeholder

The results of analyses are shown in Table 8-1.

Table 8-1 Distribution of Impact on the Related Stakeholder

Related stakeholder	Role in the project	Impacts of the project	
		Positive	Negative
A. Directly related stakeholder			
Ordinary farmers, herdsman and forest farmers	Implementation and beneficiary	Improve the producing and living conditions, provide employment opportunity, strengthen basic infrastructure construction, and provide wood materials.	After implementation, the traditional manner of forest will changed.

Forestry administrative department of banner or county	Supervise, set the principles of management and implement, and forest production sale	Possess some autonomy right, economy development, Improve living, and forest obtained protection.	Forest protection duty and responsibility will be more important.
Village collective	Supervision and beneficiary	The development of public facilities such as farmland irrigation system, traffic, electronic and drinking. Improvement of public facility, accelerating regional development, and forest obtained protection.	Project management and forest protection will be more important.
B. Indirectly related stakeholder			
Township forestry station	Implementation and technology providing	Improvement of capability, relieving forest pressure, and Improving environment.	Burden of work increasing
Township agricultural technical popularization station	Technology supporters	Settle of crops planting, diseases and insect pests' prevention, and lack of foodstuff.	Burden of work increasing, the patience of citizen, and the problem of promotion mechanisms of technology service
Township veterinary and pastoral department	Technology supporters	Livestock blast prevention, impart feed technology, and improve living condition.	Burden of work increasing, the patience of citizen, and the problem of promotion mechanisms of technology service
Banner or county government	Project coordination	Speed up becoming rich step, protection forest resource	Frustration of local resource development, whether any more capital can be collected.
Superior resource protection department	Project coordination	Forest and wildlife were protected, environmental improved.	Burden of work increasing, and how to settle the problems of manpower and capital.

8.1.3 Mitigation and Compensation Measures

Population of the project region (including banners, counties and districts) is 2908000.

Considering the prepaid capital proposed by the public consultation, matched apparatus, fund in protection, roads and electric facilities, the resolutions have been put forward as follows:

- (1) When the project is put in practice, the protection of forest will become stronger, and traditional form of using forest would be changed. It needs to enhance the propaganda work, show to public, especially the residents around the construction area, the significance of carbon sink afforestation, to make sure the farmers' participation right and right to know and local intellectual property.
- (2) The government and forestry supervision department should organize technology and management training to strengthen the administrative management capability of related personnel, increase efficiency, and reduce the burden of administration.
- (3) The related banner, county, section and station, Township Agricultural Technical Popularization Station, medical treatment organization should be strengthened the technology training, and effectively resolve the technical and medical problems occurred in construction area.
- (4) Before the project starts, "advance prophase imprest fund" and "render an account by stage" etc. should be put into effect.
- (5) Make sure the basic facilities and equipments arrive at the same time when the project break ground.
- (6) In order to forecast and prevent the harm of insect and mice and fireproofing, special funds used to tending and protection of plantation should be set up, and professional personnel should be arranged to survey the harm of insect and mice periodically, and grasped the rules of occurrence and development.
- (7) During afforestation, appropriate distance between the planted tree and high or low pressure power lines should be hold.

8.2 Analyses of Social Impact of Choosing Plantation site and Mitigation Measures

The basis for chosen of plantation site are land-use planning of variety of related banner, county, section and station, forestry planning, secondhand investigation data

to forest resources, labor force resource, land resources, water resource, socioeconomic status, transportation conditions, the requires of carbon afforestation, and the opinions of local forestry departments, communities and farmers, herdsman and forest farmers. The existed research data showed that, almost all of the people living in the afforestation area, including minorities, are supported this project. Therefore, the chosen of plantation site is not a contradiction to the desires of common people.

The social and economic benefits of this project are very remarkable. The social risk in plantation site chosen is mainly presented that, the residents living outside of the afforestation area would be mental imbalance temporary in economy, and even worse, social impact would be likely to be occurred. Above all, it is necessary to consider the all aspects of public opinions when choosing plantation site. Secondly, for the area not chosen as afforestation area, the PMO should try the best to coordinate among the different related stakeholder.

8.3 Analyses of Social Impacts of Choosing Farmers

Participating in the Project and Mitigation Measures

This project needs about 1,772,000 man-days. In addition, higher skills are not needed in afforestation so that it could be undertaken by local citizens, and it will be large numbers of citizens participating in the project. The method of adopting the participated citizens in the project are shown as follows: casual workers in construction phase and seasonal workers in running phase employed the farmers, herdsman, and forest farmers inhabiting in villages around administrative area. The forestry centre of this project, or contractors are responsible for recruitment and organization in construction phase, and forest protection, recruitment, organization in operation phase, what are demanded not to employ extra-workers, and prior consider the poor and minority people. Due to a lot of employment opportunities are provided to vulnerable groups in priority, many advantages will be brought to the poverty reduction work, and the gap between rich and poor would be reduced, hence social

risks related with gap between rich and poor will decrease in related-project counties.

8.4 Analyses of Impacts of the Use Right Transfer of Land and Mitigation Measures

According to the Chinese law, the use right of uncultivated hillside is divided into the national-owned woodland, collective-owned woodland, and individual-owned woodland due to the contract.. From Table 4-3, the land of 51 in total of 198 plots belongs to national forest land, and the other 147 plots belong to collective-owned land. So the project will not involve in the use right transfers of wood land. The policy of “who get loan, who implement the afforestation project, who manage the plantation, who repay the loan” will be enforced. Additionally, the related laws required that the farmers participating in the project have to accept land use right of 30 years if the afforestation area chosen belongs to collective land so far. ESIA team discussed with the related forestry department and village farmers on the above described issue, and the conclusion is obtained: during the implementation phase, the farmers hold land use right of 30 years, so the 147 plots of collective land will not involved in issue of use right transfers of wood land. Hence, the issue of use right transfers of wood land will not exist during the construction and operating phase of the project.

8.5 Analyses and Mitigation Measures of Impacts on Physical and Economic Resettlement of Residents

8.5.1 Physical Resettlement of Residents

All of the plantation sites of this project are wasteland since 1989, which is neither residential lands, nor production lands. These wastelands will be idled and degradation if this project is not carried out. Hence, this project will not involve in the issue of physical resettlement of residents.

8.5.2 Economic Resettlement of Residents

The methods below will be adopted in employment of labor force: casual workers in

construction phase and seasonal workers in operating phase employed farmers herdsman and forest farmers inhabiting in villages around administrative area. The forestry centre of this project, or contractors are responsible for recruitment and organization in construction phase, and forest protection, recruitment, organization in operating phase, what is demanded not to employ extra-workers. Thus, it is possible to increase the employment opportunity and income for the local citizens, and this project will not involve in the issue of economic resettlement of local residents.

External population is likely to settle in the project area owing to the social and economic benefits. Under the condition of permitting immigration by local government, employment opportunity will be provided to the poor external population and increased their income.

8.6 Impacts on Safety of Seasonal and Permanent Workers and Mitigation Measures

8.6.1 Impacts Analyses of Safety of Seasonal and Permanent Workers

8.6.1.1 Seasonal Workers

Seasonal workers mainly repair the roads and plant trees. Trees planting demands large quantity of seasonal workers, and farmers, herdsman and forest farmers living in the poverty banner/ county, including the minority will be employed as seasonal workers. The survey implied that: employment opportunity is provided to the farmers, herdsman and forest farmers participating in the project, while the seasonal worker considered it is a tiring job and the point attracting their attention is the higher payment. The basic needs of human life could be solved in close-by villages because the seasonal workers employed resided near the project area. Therefore, the health and safety of seasonal workers would not be affected by the project, while the income of local citizens, local economy and living standards will be improved for the implementation of this project.

8.6.1.2 Permanent Workers

“Contract system” is adopted during the project operation. Local contractor possess the management right of forest, and they would employ some common workers as permanent workers, due to low education background and low income of these permanent workers, there will be possibly several potential risks in safety such as:

(1) Chemical insecticide and pesticide will be used during the reservation process, which may pollute the source of dinking water, and indirectly threaten to the human health and security.

(2) The permanent workers possibly could not obtain the wages and bonus timely.

8.6.2 Mitigation and Compensation Measures of Impacts Generated during Construction and Operation Phase

(1) During the project construction process, it is necessary to strengthen the occupational safety and health management, adopt effect measures to guarantee the health and safety of every member in the construction project (e g. building medical stations or fully preparing medical articles and daily medicines), make sure the safety production, and prevent occurring accident and occupational hazard.

(2) Organizing workers in the construction project to study occupational safety and health, and enhance the consciousness on occupational safety and occupational health.

(3) Reduce amount of the agrochemicals (pesticide and fertilizer) used to contaminate the groundwater, advocate to use the green peat fertilizer (organic fertilizer). Try the best not to use pesticides to prevent plant diseases and insect pasts.

(4) The related departments should monitor the contractors strictly, so as to put an end to occurrence of defaulting of the wage and bonus of seasonal workers and permanent workers.

8.7 Analyses of Impacts on Vulnerable Groups and Mitigation Measures

8.7.1 Analyses of Impacts on Women Groups

Realization of equality between men and women is one of the basic state policies in China. The item that women will gain equal rights with men in politics, economy, civilization, society and family and so on is definitely regulated in the “*Chinese Constitution*”. Since 1994, based on enforcement of the “*Law of the Peoples Republic of China on the Protection of Rights and Interests of Women*”, the “*Law of the Peoples Republic of China on Maternal and Infant Health Care*” was promulgated, the “*Marriage Law of the People's Republic of China*” and other laws were emended. Subsequently, the above laws are strengthened in the bylaw of the “*Outline of Chinese Women Development*” (2001~2010), especially concerning the matters related to rural women’s basic right.

Among the surveyed farmers, 64% of surveyed family expressed that the significant family affairs were decided by husband, while 35% expressed that the significant family affairs were decided by both of them. When questions such as who possesses the using right of self-retention forest land, who will go to plant trees and who will participate in afforestation technical training etc. were asked, only 1% of the answers was that the decision was up to the husband, while the remaining 99% of family answer was that the decision was up to the both of them. The results of survey showed that women have the equal right with the men in family, and sex would not affect the farmers’ judgments on this project. At the same time, it should be paid more attention that women accounted large proportion in total of seasonal workers, and women would like to be forest guard ranger in other surveyed regions. All of these obtained results will attract women to participate in this project.

The existed research data showed that this project would bring various benefits. The most direct benefit is to provide employment opportunity for woman or her husband

and then increase income of the family, especially for the women in poor area, the project reduce the farmer's economical pressure and mental pressure at certain extent. Secondly, a batch of irrigation facilities will be built and then improve the district public facilities condition. These improvements would create conditions of variety of livestock production for women and enhance their status in family.

8.7.2 Analyses of Impacts on Poor Community and Poor Farmer Households

The work of planting trees, which does not need much skill during the implementation of project process, will be undertaken by local residents, and they did not have to repay loan. Therefore, poor farmers possibly can not contract forest and be more likely to work as seasonal workers. The survey of environmental and social impact assessment team indicated that poor families and families who are not so poor are all have family members working outside. Vulnerable groups in the surveyed objects are farmers whose living levels are close-by the poverty line. Comparing to working in the outside, the farmers would like more to plant trees in their hometown.

The project requires a total labor of 1.772 million man-days, namely 106.32 million Yuan will be provided to the farmers who work for project, of which the Hohhot region requires 248000 man-days, the Baotou region requires 693000 man-days, the Tongliao region requires 517000 man-days, and the Bayannaer requires region 314000 man-days. During the construction phase of 5 years, this project can provide employment opportunity of 60 man-days per year to 5900 non-skilled workers, who mostly come from local village. It is namely 3600 Yuan per year, which exceeds the income of poor community greatly and is 3.76 times of the lowest income standard. Hence, many poor farmers resided in project region will participate in this afforestation project, and they would get the work which is low-risk, more generous reward and near hometown, and also can improve the quality of their life.

8.7.3 Analyses of Impacts on Minority Groups

Mongolian is the major minority in Inner Mongolia Autonomous Region. While Han ethnic group is the majority in multi-nationality area in Mongolian, and the main ethnic group is Manchu, Hui and Han ethnic. Specific distribution and population quantity are shown in Table 4-2. The living habits of most of minority have been already the same as Han. What the minority have the equal opportunity with the Han is the one of the basic principles of the project and the minorities have equal project benefits with Han. Especially for the poor minorities, they would have priority to take part in the project.

Unique customs should be avoided being disturbed during the forest construction. For example, once the Obo of Mongolian is encountered, the afforestation should keep away from the Obo and protected the unique customs. Therefore, the negative effects on the culture customs caused by the project can be negligible.

The positive effects on the minorities brought by the project mainly showed at two points:

- (1) Employment opportunity would be provided to the minorities, and increased their income.
- (2) Promoting the communication of culture between the minorities and Han for more chance of working, operating and managing together.

8.7.4 Compensation Measures of Impacts on Various Vulnerable Groups

Mitigation and compensation measures to the negative effects on the vulnerable groups are listed as follows:

- (1) The construction and operation of process must obey the laws or bylaws such as the "*Labour Law of the People's Republic of China*", the "*Law of the People's Republic of China on the Protection of Disabled Persons*", the "*Law of the People's*

Republic of China on the Protection of Minors”, the “*Outline of Chinese Women Development*” (2001~2010) and the “*Law of the People's Republic of China on the Protection of Rights*” and so on. Put an end to the occurrence of discrimination of the women and the minorities.

(2) Try the best to consider the poor community in the construction phase, and provide the employment opportunity for poor farmers, increase their income and promote economic development.

(3) According to the actual site conditions of the areas inhabited by the minority ethnic groups, and acquiring from the experienced forest farmers, afforestation and its mode could be adjusted properly.

(4) Exterior supervising system should be established to protect the vulnerable groups' interest in the implementation and running phase. Due to the potential risks existing in the above described vulnerable groups, the project implementation office should assign related personnel to do supervision, especially for the areas inhabited by the minority ethnic groups.

8.8 Analyses of Impacts on Social Economy of the Project and Measures to Risks

8.8.1 Forecast of Income of Main Forestry Products and Analyses of Finance

The main forestry products and their incomes of the project were listed in Table 8-2 and the analyses of finance since project operation in Table 8-3. The data indicated that the finance internal rate of return is higher than industry benchmark yield (8%) if profit of carbon sequestration is not considered, what imply the profitability of the project. While the debt-service coverage ratio is 3.99% according to conservative budget, indicating the strong assurance capability to return loan and interest.

Table 8-2 Income of Forest Products

	Carbon sequestration budget	Wood (poplar)	The herba cistanche products	Caragana products
Yield (m ³ /a , Ton /a)	-	170,100	4,153.5	65,115
Unit Price (Y/m ³ , Y/Ton)	-	500	20,000	400
Revenue(Y/a)	138,468,000	85,050,000	83,070,000	26,046,000

Table 8-3 Finance Analyses

Detail	Value (without consideration of carbon trade)	Value (consideration of carbon trade)
Total Investment profit in project calculation stage (Y)	11,988,340,000	11,618,694,000
Total investment yield (%)	18.0	23.4
The profit margin of capital during prosecution (%)	15.2	20.6
Financial inner yield (%)	12.8	13.3
Investment reclaim period (years)	9.3 (including 5 years construction stage)	12.13 (including 5 years construction stage)
Debt service cash reserve ratio (%)	3.99%	

8.8.2 Risk Analyses and Mitigation measures

8.8.2.1 Market Risks

In order to ensure the operation of the project and return the loans smoothly, definite profits in running stage is very important. The cost is likely to be increased, such as the price of raw material, labor power and so on, so the profits will be affected at the same time. On the demand aspect, though the conservative calculation is adopted in the project, the market demand could be satisfied. Maintaining the priority of the products and stronger competition are still existing risks. In addition, the yields and selling price may be affected by unexpected factors.

So the mitigation measures are listed as follows:

(1) The conservative calculation is adopted in the project, but the price is likely to rise during actual sales. In addition, the chosen products are salable products, and have

vast market potential. Due to the rising price of raw materials, the products price may be soaring, and the profits will not be reduced.

(2) This project applies present common production and management technology to produce the products. Under furious competition, the forestry department has been investigating the Herba Cistanche products. The scientific and technical content of products will increase if State Forestry Bureau and local government combined scientific practical technologies with local products. With the completion of capital and technology, the primarily products could be processed ulteriorly, and then the value of products will be greatly increased, so it is possibly to maintain the lasting competitiveness of the products.

(3) Strengthen the market management, and establish comprehensive plans of produce and sale and scientific marketing strategy. The plan should be strictly implemented, and negative factors should be predicted, and preventive measures should be formulated. If some problems occurred, counterplan should be used to reduce the investment loss to the minimal extent.

8.8.2.2 Management Risks

All economic indexes of this project are the average value based on the usual manufacturing, existed management mode and experience. However, the project covers 4 cities (league); great differences existed in physical geography conditions, so the yields and quality of products are vulnerable to natural disaster and management level. Therefore, the risks of prevention of fire and unlawful felling tree exist and experienced manager and protectors will be needed. Once the ability and level of members occurred oversight in some step, or management is not functioned in time, the cost of operation may properly increase, and affect the quality and income of products.

Mitigation measures: make all-sides investigation, evaluate of the management risks, predict possible negative factors and areas existed, and prevent measures to be operated at key step and areas. For the management, strengthen the track and monitor

work, predict possible regulations and rules, put into effect of the responsibility system or targeting system on office, and arrange the principle of individual rewards and punishment for management level and effect. Additionally, establish effective operation and management system for the project.

8.8.2.3 Policy Risks

The major policy risks of the project products are the wood lumbering management. High-yield poplar plantation is chosen as the timber forest in this project. These woods are mainly used to business, as raw material of pulp and paper and wood-based panel, to increase the revenue of local citizens. So this kind of woods has been not limited in amount of cutting. The main policy in China in cutting *Caragana* is to meet the demand of local agriculture and increase the income of local citizens. With the implementing of scientific development view, construction of new social countryside and forestry in China, the policy risks in poplar and *Caragana* lumbering became much smaller in the new stage.

9 Environmental and Social Management and Monitoring Plan

9.1 Implementation Organizations and Responsibilities

9.1.1 Implementation Organization

To ensure the effectiveness and impartiality of environmental management, an independent environmental and social department (ESD), which has no interest conflict with departments of the construction and operation departments, should be set up. This department is responsible for environmental and social management of the project. This department is composed of the following units, as shown in Figure 9-1.

Environmental and social department is composed by a leadership, an environmental management staff and a community management staff. Mainly responsible for the following work:

- (1) Preparation of environmental and social specifications for the contractors in charge of the construction in coordination with environmental and social department.
- (2) Supervising construction activities.
- (3) Supervising the implementation of the mitigation measures, including the social impact mitigation measures.
- (4) Coordination of environment (including air, noise and water quality) monitoring and environment surveillances.
- (5) Reporting the situations of non-compliance observed on the site to project implementation unit (PIU).

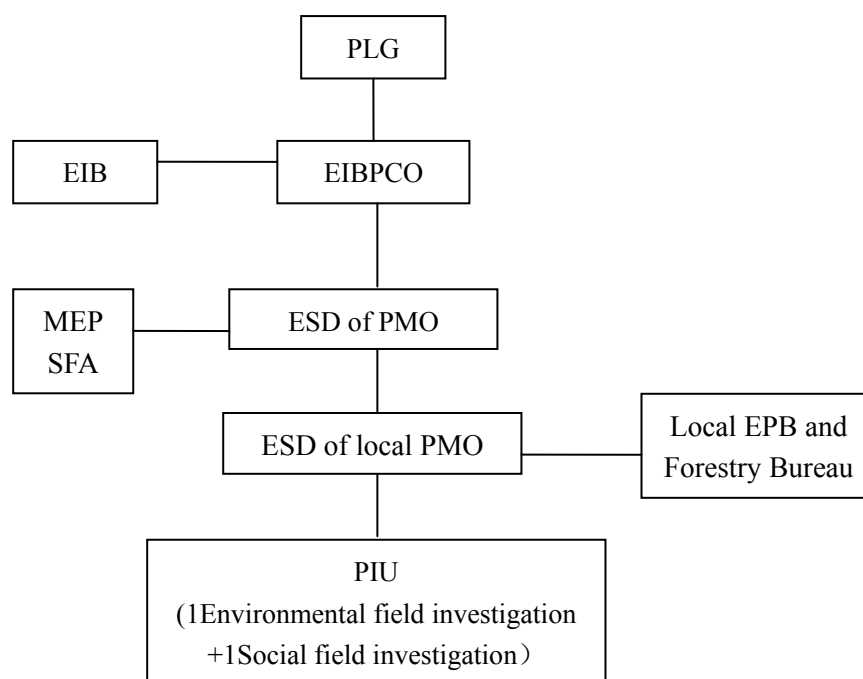


Figure 9-1 The Organization of Environmental and Social Department in Project Construction Phase

9.1.2 Role of PMO at all Levels and Environmental Officers

PMO at all levels commit to implement project management and monitoring plan at appropriate level. In the environmental and social management, they organize the establishment of the environmental and social department, coordinate with local environmental officials, and are responsible for ensuring that the mitigation measures and monitoring plans, which are proposed in the report of environmental and social assessment, have been implemented successfully. The main responsibilities include:

- (1) Checkup and ensuring that activities of mitigation measures and monitoring will be put in practice.
- (2) Ensuring that the mitigation measures of Environmental and Social Management and Monitoring plan (ESMMP) to be reflected in the final project plan, and cooperate with the project design and construction teams closely. At the same time ensure that the necessary conditions for project monitoring should be appropriated in time.
- (3) Providing the necessary training about environmental and social issues to project office personnel at all levels and sub-project implemental staff, in order to enhance

institutional implementation capacity of the county and township staff on the implementation of ESMMP.

(4) Supervising implementation situation of environmental and social measures in ESMMP.

(5) Providing the guiding suggestions in written in case of environmental standards are not reached, and taking actions to improve.

(6) If environmental and social emergency accidents happen, reactive plans should be implemented in time. Any environmental and social incidents or disasters should be reported to the local government, the local Environmental Protection Bureau and Forestry Station.

(7) Implementing ESMMP, including supervision and monitoring of the organizations in order to sample in time following provisions of the monitoring plan.

(8) Reporting environmental quality and associated social impact periodically in the course of project construction and operation to the relevant environmental management departments and EIB.

(9) Transacting complaints on environmental and social problems, and being supervised by governments, environmental protection departments and forestry sectors.

(10) Supervising environmental issues of the process of implementation and construction, at the same time supervising construction teams to follow the relevant requirements.

9.1.3 Supervision Organizations

The plan of project supervision organizations and contents are shown in the Table 9-1.

9.1.4 Environmental and Social Management Plan

In order to ensure that environmental mitigation measures will be implemented effectively, the project established an environmental and social management plan, with details are showed in Table 9-2.

9.2 Environmental and Social Monitoring Plan

9.2.1 Monitoring Items

The major monitoring items of the project include: the physical environment indicators, indicators of the ecological environment, socio-economic indicators, the conventional indicators of plantation (the survival rate and preservation rate) and indicators of carbon sequestration and so on. The main items of various monitoring indicators are showed as follows:

- (1) Physical environment indicators: surface water (pH, SS, hypermanganate index, ammonia nitrogen, total phosphorus and total nitrogen) and atmosphere (TSP).
- (2) Ecological environment indicators: plant diversity (type, quantity, coverage, distribution and growth), animal multiplicity (bird), soil erosion, and soil fertility (organic compounds, total nitrogen, organic phosphorus, total potassium and pH).
- (3) Socio-economic indicators: per capita income and total economic output.
- (4) Plantation conventional indicators: survival rate and preservation rate.
- (5) The characteristics of plantation indicator: carbon sequestration.
- (6) Risk indicators: pests and diseases, forest fires.

9.2.2 Monitoring Implementer

The implementers of monitoring are shown in Table 9-3.

9.2.3 Monitoring During Implementation

The plan of monitoring during implementation is shown in Table 9-3.

9.2.4 Monitoring During Operation

The plan of monitoring during operation is shown in Table 9-3.

Table 9-1 Environmental and Social Monitoring Plan

Stage	Supervision organizations	Contents of supervision	Purposes of supervision
Feasibility study stage	EIB, IMEPB, IMFA, IMPG	(1) Reviewing the EIA (2) Reviewing the ESMMP	(1) To ensure that ESIA is comprehensive and given emphasis to the outline. (2) To make sure the potential and important environmental issues caused by the project. (3) To put forward concrete and feasible mitigation measures.
Design and Construction stage	IMEPB	(1) Reviewing the preliminary design of environmental protection and environmental monitoring plan	(1) To implement environmental and social management and monitoring plan strictly. (2) To consider all the national laws and regulations relevant to the implementation /construction period.
	IMEPB	(2) Verifying the investment of environmental protection	(3) To ensure sufficient investment in environmental protection.
	IMPG, IMEPB, IMFA, every city government, EPB and forestry bureau of local banner, county or district	(3) Verifying the choice of project region and the methods of reclamation and planting	(4) To verify planning region whether or not suitable for the development of carbon sequestration afforestation, reclamation and planting whether or not implemented by the relevant norms, whether or not reserve the original vegetation in the gully, and the project will not affect the biological diversity seriously. (5) To ensure that the project is away from the regional nature reserves and natural forests, and that the project does not impede wildlife migratory routes.
		(4) Checking the water supply situation in the project area	(6) To avoid non-renewable influence to underground water resources.
		(5) Checking soil erosion situation caused by construction of the project	(7) To ensure that soil erosion control measures following the environmental management and monitoring plan, and national and local laws to be implemented.
		(6) Checking collocation of the tree species	(8) To ensure that the balance of insects and their natural enemies, and to improve the pest's ability to regulate its own balance.

Stage	Supervision organizations	Contents of supervision	Purposes of supervision
		(7) Checking issues of the energy and grazing for farmers	(9) To solve farmers' energy issue and the source of life, and avoid the emergency of social and national contradictions.
		(8) Checking the impact on vulnerable groups	(10) To avoid the influence on the women, poor farmers and minorities.
		(9) Checking the working conditions of seasonal workers	(11) To ensure the health and safety of seasonal workers.
Operation stage	IMPG, IMEPB, IMFA, every city government, EPB and Forestry Bureau of local banner, county or district	(1) Checking implementation of ESMMP. (2) Checking whether it is necessary to take further measures to solve the unpredictable environmental and social issues	(1) To protect the environment in order to minimize the environmental impact during operation period. (2) To review and improve ESMMP to lessen the unpredictable impact if necessary. (3) To minimize the impact of natural resources, especially the impact of natural forests and water.
		(1) Checking whether or not the project causes unpredictable pressure on natural forests and water (2) Checking whether the project is being accelerated soil erosion. (3) Checking up pesticide use of the project areas	(4) To report any misconduct to the relevant management institutions. (5) To ensure that the project will not have negative impact on the water and downstream water users, and report any misconduct to the relevant management institutions. (6) To monitor and check the use of pesticides on control of diseases and pests, and ensure that pests and diseases management plan is implemented completely, and the use of the pesticide will not contaminate surface water and groundwater sources.
		(1) Checking the economic status (2) Checking safety of working conditions and wage payment for the long-term workers	(7) To ensure that poverty-stricken households can get employment opportunities. (8) To ensure that long-term workers have safe working conditions. (9) To ensure that the long-term workers get the payment of wages.

Table 9-2 Environmental and Social Management Plan

Environmental issues	Mitigation policies and control measures	Implementer	The responsible institution
A. the Previous stage of design and construction			
Project scheme	(1) Optimize the project design and planning, so as to minimize the potential negative impact to environment; (2) The construction progress should be arranged reasonably to shorten the occupation of land; (3) To minimize the impact of the region's water resources, the requirements of the minimum flow and downstream water users' requirements; (4) PMO should strengthen the monitoring and protection work of biodiversity in project areas; (5) Select species carefully to protect the safety of local species and avoid the interference of foreign species; (6) Ensure local energy source of farmers; (7) A single clone plantation of large area is not allowed and each county at least has 10 clones.	ARPMO and Design Unit (DU)	ARPMO
Land use	(1) Forest Road must be designed to minimize the occupied land, prevent accelerating of soil erosion and avoid / minimize the damage to vegetation; (2) Ensure that all lands are non-forest wasteland; (3) Historical sites and cultural remains can not be used to construct plantations; (4) Slopes more than 35° can not be used to afforestation.	DU	ARPMO
Pesticide use	Check up the use of pesticides in all project areas, choose the substitute chemicals of high effective pesticides, advocate low-residue pesticides to be used, and strengthen the implementation of pest management plan. Details are showed in Appendix F: Pests and diseases control plan.	Autonomous regional pests and diseases control station	ARPMO
B. The implementation phase			
Soil erosion	(1) Full reclamation soil preparation is strictly prohibited. The pit and fish-scale pit soil preparation methods will be adopted; (2) Afforestation at slopes should be completed at least one month before the onset of the rainy season;	Construction Unit (CU)	ARPMO, PMO of county

Environmental issues	Mitigation policies and control measures	Implementer	The responsible institution
	<p>(3) Avoid reclaiming and digging holes and canal at slopes more than 35°. And cover declivity of the digging area with sandbag and hay bag to reduce soil erosion;</p> <p>(4) Replanting in construction site should be implemented as soon as possible after the end of construction to prevent soil erosion;</p> <p>(5) Protect the surface vegetation by using remains of harvesting;</p> <p>(6) separate harvest should be adopted based on the project design scheme to avoid damaging the remained trees and soil;</p> <p>(7) Take measures to maintain and improve soil structure, soil fertility and biological;</p> <p>(8) Advocate the use of organic manure, green manure and interplant fixed plants among woods;</p> <p>(9) Fertilize soil with organic fertilizer according to the design of afforestation, and spot application or row application can only be used. Spreading is strictly forbid.</p>		
Plant diseases and insect pests	<p>(1) Multi-species, multi-source, multi-gene and mixed afforestation;</p> <p>(2) The alien species will not be introduced by the project;</p> <p>(3) Retain the original vegetation;</p> <p>(4) Make full use of biological methods to pest control, and avoid large-scale use of chemical pesticides.</p>	DU	ARPMO
Project stakeholders	<p>(1) Intensify propaganda, and popularize the significance of carbon sequestration to the public especially the surrounding residents of construction areas;</p> <p>(2) Resolve villagers' energy issues;</p> <p>(3) Relevant government departments should help and guide farmers to undertake intensive animal husbandry;</p> <p>(4) Organize regularly technical and management training, and enhance the technology and administrative capacity of related personnel;</p> <p>(5) Implement the matters concerned such as "pre-paid pre-working capital" and "phased accounting".</p>	ARPMO and Epidemic prevention department	ARPMO

Environmental issues	Mitigation policies and control measures	Implementer	The responsible institution
Rights of vulnerable groups	(1) Try the best to pass through poor communities in the course of construction to provide poor farmers employment opportunities and increase farmers' income; (2) Listen to the suggestions of the local experienced households according to the specific site conditions of minority habitation; (3) Establish the outer supervision system to protect the rights of vulnerable groups; (4) Respect for lifestyle and traditional custom of minority. Enhance the consciousness of contractors and civilian workers to respect for minority habit and belief by distributing leaflets, training and other means.	ARPMO	ARPMO
Safety and health of seasonal workers	(1) Establish provisional sanitary and epidemic prevention institution in construction areas, and strengthen the epidemic surveillance, health management and health promotion; (2) Recruit workers in adjacent village during the construction period, to solve the problem of accommodation and drinking water; (3) Improve the living conditions of seasonal workers.	PMO and CU	ARPMO
C. The operational phase			
Use of chemical fertilizers for plant diseases and insect pests	(1) Implement the plan of pest management (Annex F) strictly, and improve efficiency of pesticides use to minimize the long-term negative impact to the natural environment; (2) Select good forest management measures to strengthen the capacity of resistant to disease and insects; (3) Select the low residual and low toxic pesticides; (4) Serious pest populations should be monitored regularly; (5) Popularize the integrated pest management, and reduce the use of chemicals.	PMO of county and forest pest and disease control station	ARPMO

Environmental issues	Mitigation policies and control measures	Implementer	The responsible institution
Soil erosion and soil fertility	(1) Protect vegetation on the forest land, and make use of soil to cover plants; (2) Avoid <i>Cistanche</i> to be dug in windy weather; (3) Implement soil testing and balanced fertilization technology; (4) Use organic fertilizer as much as possible, and popularize bacterial fertilizer; (5) Remain logging residues in the forest; (6) New forest road should have measures of water and soil conservation.	PMO of county and CU	ARPMO
Biodiversity	(1) Protect undergrowth vegetation and forest litter, the original vegetation between the lines, and forest edge vegetation; (2) Popularize integrated pest control and strengthen management of forest health and reduce the use of chemicals.	PMO of county and CU	ARPMO
Environmental pollution	(1) Lessen use of chemical fertilizers and pesticides, or else use them timely and with proper quantity; (2) Select organic manure and green manure; (3) Adopt ditch and pit fertilizer application, and then cover with soil and deadwood; (4) Select the low toxic pesticides; (5) Recycle the packaging of pesticides and fertilizer.	PMO of county	ARPMO
Forest fire control	(1) Implement fire prevention and control plan (Annex E) strictly.	contractor unit, PMO	PMO
Vulnerable groups	(1) Provide employment opportunities to poverty-stricken households and help them increase income; (2) Support employment of minority and women; (3) Respect for the customs and habits of minority.	PMO of county	ARPMO
long-term workers	(1) Be strict with the contractor's supervision and management system, and eliminate the incidents about defaulting wages and bonuses of seasonal workers and long-term.	PMO of county	ARPMO

Table 9-3 Environmental and Social Monitoring Schedule

Environmental factors	Monitoring point	Monitoring items	Monitoring frequency	Monitoring implementer
Basic data collection				
Atmospheric environment	Select three representative settlements.	TSP	1 time, the end of a first-year	EMS of county, banner
Surface water	Select cross-sections in upriver, middle reach and low reach of DaguoRiver in saihan district, Hohhot, the main river in Jinshan town, Guying county, Baotou City and three representative rivers in Kerqin district, Tongliao city.	pH, SS, hypermanganate index, ammonia nitrogen, total phosphorus and total nitrogen	1 time respectively in high water season and normal water season	EMS of county, banner
Carbon sequestration	Select 1 typical plot per county, banner or district.	baseline data: biomass overground, biomass underground, withered matter, thick woodiness ort and soil organic carbon	1 time, the end of a first-year	FMPA and CAF
Socio-economic	Project areas	per capita income, total economic output	1 time, the end of a first-year	county, banner governments
The implementation phase				
Surface water	Cross-sections at upper, middle and low reach of rivers near the project areas.	pH, SS, hypermanganate index, ammonia nitrogen, total phosphorus and total nitrogen	1 time respectively in high water season and normal water season	EMS of county, banner
Atmosphere	Settlements and the construction site	TSP	1 time per quarter	EMS of county, banner

Plant multiplicity	Select 1 plot in every city, and 2 repeated sample plots and 1 comparison plot per plot (namely 12 plots in all)	type, quantity, coverage, distribution and growth	1 time, the end of a first-year	FMPA
Animal multiplicity	Select 2 sample plots per banner, county or district	bird	once per spring	FMPA
Conventional indicators of plantation	Every plantation site of project area	the survival rate and preservation rate	once per spring	FMPA
Soil fertility	Select a representative plantation in every city of the project areas, 4 in all.	organic matter, total nitrogen, effective phosphorus, total potassium and pH	1 time, the end of the first-year	FMPA
Soil erosion	Every plantation site of project area	data of rainfall(from the provincial / municipal meteorological station),the amount of soil loss, total phosphorus and total nitrogen, total potassium and pH.	3 times the first year after afforestation begin, and then 1 time per year the 2 nd ~ 5 th year.	FMPA
The operation phase				
Surface water	In the vicinity of forestland	pH, SS, hypermanganate index, ammonia nitrogen, total phosphorus and total nitrogen	1 time respectively in high water season and normal water season	EMS of county, banner
Plant multiplicity	Select 1 plot in every city, and 2 repeated sample plots and 1 comparison plot per plot (namely 12 plots in all)	type, quantity, coverage, distribution and growth	once every two years	FMPA
Animal multiplicity	Select 2 sample plots per banner, county or district	bird	once every spring	FMPA

Conventional indicators of plantation	Plantation site of every project area	The survival rate and preservation rate.	once every spring	FMPA
Soil fertility	Three representative plantations	organic matter, total nitrogen, organic phosphorus, total potassium, effective calcium, magnesium and pH	once every two years	FMPA
Soil erosion	Every plantation site of project area	data of rainfall, the amount of soil loss, organic matter in sediments, total nitrogen, total phosphorus ,total potassium, effective nitrogen,effective phosphorus,effective potassium and pH	once a year	FMPA
Carbon sequestration	Every plantation site of project area	baseline of woodland, biomass overground, biomass underground, withered matter, thick woodiness ort , soil organic carbon, plant organic carbon, soil breath intensity, and plant photosynthesis intensity and breath intensity	once every five years	FMPA and CAF
Socio-economic	Project areas	per capita income, total economic output	once per year	county, banner governments

9.2.5 Monitoring Report System

The system of monitoring report is shown in Figure 9-2. After the completion of each task of monitoring, the monitoring implementer must prepare a monitoring report. The report should include monitoring data and improved suggestions, and reflect the assessment of the implementation of social and environmental protection measures. Then submit monitoring report to the Autonomous Regional Project Management Office (ARPMO). After PMO receives the monitoring report, various measures should be improved according to the report. In the implementation phase / construction phase and the first five years in operation phase, the ARPMO should submit annual environmental quality report to EIB. If necessary, the report should be submitted to IMEPB and MEP, too. The procedure of monitoring report is shown in Figure 9-2.

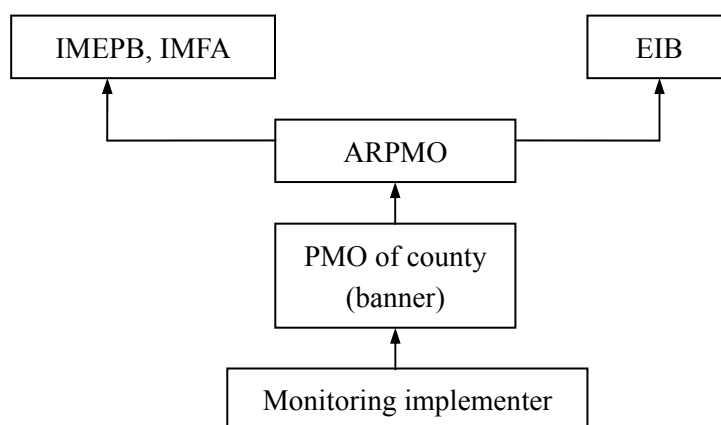


Figure 9-2 The Diagram of Monitoring Report

9.2.6 Monitoring Budget

The project budget of monitoring plan is shown in Table 9-4.

Table 9-4 The Budge of Environmental and Social Monitoring

Monitoring phase	Environmental parameters	Cost (Y)
Investigation	surface water quality	11,000
	atmosphere	6,000
	carbon sequestration	771,000
Subtotal		788,000

Construction period (five years)	surface water quality	55,000
	atmosphere	30,000
	plant biodiversity	31,000
	soil fertility	30,000
	soil erosion	31,000
	animal multiplicity	50,000
Subtotal		227,000
Operating period	surface water quality	55,000
	plant biodiversity	93,000
	soil fertility	60,000
	soil erosion	78,000
	plant biodiversity	90,000
	plant biodiversity	4,000,000
	economic indicators	50,000
Subtotal		4,426,000
Total		5,481,000

9.3 Training/Institutional Strengthening Plan

To ensure the development of environmental management be favorably and effective, knowledge and skills training is essential to the related personnel. The training not only introduces the importance of this project and the significance of implementation to all the staff, but also does different type of training for the different positions. The training plan of related personnel is showed in Table 9-5.

Table 9-5 Environmental Managers Training Plan of the Plantation

Project areas	Phase	Category	Number of people	Total	Time (year)	Cost (Y)
Hohhot City	Implementation phase	environmental managers	ESD: 3	3	2009	6,000
		environmental supervision engineers	Construction contractor: 3 PMO: 3	6		12,000
		pest and disease control managers	Construction contractor: 3 PMO: 3	6		12,000
		forest fire control managers	Construction contractor: 3 PMO: 3	6		12,000
	Operation phase	environmental managers	ESD: 3	3		6,000
		pest and disease control managers	Woodland contractor: 3	3		6,000
		forest fire control managers	Woodland contractor: 3	3		6,000
		training teachers to farmers	PMO: 1	1		2,000

	Subtotal			31		62,000
Baotou City	Implementation phase	environmental managers	ESD: 5	5	2009	10,000
		environmental supervision engineers	Construction contractor: 5 PMO: 5	10		20,000
		pest and disease control managers	Construction contractor: 5 PMO: 5	10		20,000
		forest fire control managers	Construction contractor: 5 PMO: 5	10		20,000
	Operation phase	environmental managers	ESD: 5	5		10,000
		pest and disease control managers	Woodland contractor: 5	5		10,000
		forest fire control managers	Woodland contractor: 5	5		10,000
		training teachers to farmers	PMO: 1	1		2,000
Subtotal			51		102,000	
Tongliao City	Implementation phase	environmental managers	ESD: 4	4	2009	8,000
		environmental supervision engineers	Construction contractor: 4 PMO: 4	8		16,000
		pest and disease control managers	Construction contractor: 4 PMO: 4	8		16,000
		forest fire control managers	4	4		8,000
	Operation phase	environmental managers	ESD: 4	4	2009	8,000
		pest and disease control managers	Woodland contractor: 4	4		8,000
		forest fire control managers	Woodland contractor: 4	4		8,000
		training teachers to farmers	1	1		2,000
Subtotal			37		74,000	
Bayan-naoer	Implementation phase	environmental managers	ESD: 1	1	2009	2,000
		environmental supervision engineers	Construction contractor: 1 PMO: 1	2		4,000
		pest and disease control managers	Construction contractor: 1 PMO: 1	2		4,000
		forest fire control managers	1	1		2,000
	Operation phase	environmental managers	PMO: 1	1		2,000
		pest and disease control managers	Woodland contractor: 1	1		2,000

		Forest fire control managers	Woodland contractor: 1	1		2,000
	Subtotal			9		18,000
	Total			128		256,000

10 Conclusion and Recommendations

10.1 Major Conclusions

The EIB Loan CDMAP is the public interest carbon sequestration afforestation project started by state, giving attention to the ecological benefits and farmers' income. Taking into account for ecological, social and economic benefits simultaneously, this project is constructed in accordance with policy of addressing climate change, ecological construction and forestry industrial development in China, and on the basis of compliance with the local economic and social development needs, as well as local land-use planning.

The ecology and living environment would be improved, if the project is successful implemented, with the increase of the percentage of forest cover and biodiversity in the project areas, especially in areas threatened by desertification, the project would play a role of fixing sand, conserving water sources and soil. At the same time the industrial structure could be adjusted and regional economy could be developed in sand area. So the pressure on local employment will be alleviated, and then the life quality of residents could be improved along with the increase of their income in the project area.

According to the principle of approaching to different land and different trees, appropriate trees and species provenance, the plantation site, tree species and afforestation modes were selected in this project. Patch mixed, strip mixed, and inter-row mixed afforestation modes would be adopted with native trees selected in this project, and all afforestations are non-forest wasteland. Due to the small size of every single plantation site relatively, the risk of diseases and insect pests could be reduced. Water and soil conservation measures could be adopted during the process of the soil preparation, planting and so on. Further more, the protection of biodiversity and ecosystem stability should be paid more importance to throughout the whole process of afforestation project.

Taking into account of environmental protection, eco-efficiency, social and economic benefits as well as the wishes of the public, it seems that the degree of the adverse environmental and social impact could be minimized through adoption of the corresponding mitigation measures after the implementation of environmental protection measures and regulations strictly, and then strengthening the whole process of project management, monitoring and supervision, therefore, this project is feasible from the point of environmental and social impact.

10.1.1 Selection of Plantation Site

The project is located at 8 counties (banners and districts) and 1 desert control test station in Hohhot City, Baotou City, Tongliao City and Banyannaer City separately. The afforestation category of desert control comprehensive test station in Banyannaer City is a major shelter forest, and some other sites have parts of timber forests. With a full account of geographical conditions, environmental benefits, social benefits and wishes of the public, the selection and layout of the plantation sites meet the project design principle. Therefore, this project is reasonable from the point of plantation site selection.

10.1.2 Physical and Ecological Environment Impact Analyses and Proposed Mitigation Measures

10.1.2.1 Analyses of Impact on Physical Environment and Proposed Mitigation Measures

(1) Water Environment

The effects on water environment of this project mainly come from the misuse of pesticides and chemical fertilizers. So it is suggested to establish perfect pests monitoring and prevention system, use biological methods to reduce the use of pesticides, and handle the casing of pesticide and fertilizer appropriately.

(2) Air Environment

The effects on air environment of this project mainly come from the dust during forest road construction process. So it is suggested to adopt measures to reduce the area of ground breaking as much as possible, recover the vegetation as soon as possible, and also do not arrange constructions in gale or rain weather. However, a whole air environment quality will be improved along with increasing of the vegetation coverage percentage in operation stage.

(3) Acoustic Environment

The effects on acoustic environment of this project mainly come from the noise produced by construction machines during forest road construction process. So it is suggested to keep the selected road lines away from sensitive area, and to forbid night construction.

(4) Solid Waste

The main solid waste of this project is domestic waste generated by workers. Accordingly, it is suggested to employ the villagers nearby as the worker of the project, so that no additional population and solid waste in the project areas.

(5) Soil Environment

The soil environment pollution of this project is mainly produced by misuse of pesticides and chemical fertilizers. Thus, organic fertilizer or manure should be recommended, and the casing of pesticide and fertilizer should be handled appropriately.

10.1.2.2 Analyses of Impact on Ecological Environment and Proposed Mitigation Measures

The forest area will increase 31805.7 ha following the completion of the project. With the increasing of the vegetation coverage percentage, it could be formed an ecological barriers, which the function of windbreak and sand fixation will be enhanced. Accordingly, soil erosion should be reduced, climate should be adjusted, eco-environment should be improved, and then there will be a significant ecological benefit.

(1) Biodiversity

The land surface will be disturbed by soil preparation, planting, tending stages, and logging, and digging during this project. It could be induced short-term damage to the original vegetation. So some effective protect and restore measures should be adopted, such as, to prohibit large-scale soil preparation, to replant and restore vegetation after logging or digging as soon as possible. Plant diversity of forest land will be more abundance than the original wasteland. At the same time, wildlife habitat will be improved and animal diversity will be increased along with the increasing of vegetation cover. In a word, biodiversity will be increased in the project area.

(2) Water Resources

Water demand is attributable to the trees irrigation during the implementation phase in the project, and existing water sources in each project area might meet the needs of irrigation by water consumption prediction. At the same time, the project sites are all located in arid, semi-arid and water shortage areas, so water-saving measures must be adopted throughout the process of afforestation to reduce the waste of water resources. As the project will have been completed, the forest itself has the function of water conservation, and there is no longer needed for irrigation. Therefore, the pressure of water resources demand will be relieved.

(3) Soil and Water Conservation

As the function of soil and water conservation of the forest, for a long-term, the development of this project is beneficial to the soil and water conservation. But the new soil erosion might occur in the process of forest road construction, soil preparation and digging *Cistanche deserticola* Ma.. Soil and water conservation measures should be adopted when the slope is more than 5° of the afforestation, and the slope more than 35° does not selected as afforestation. Also do not arrange construction activities in windy and rainy days, such as forest road construction and site preparation etc. Moreover, blocking and protecting equipment will be suggested to adopt, and to take measures as soon as possible to restore vegetation.

(4) Soil Fertility

Soil fertility could be improved by proper fertilization and irrigation in project areas with desertification badland. Moreover, the deadwoods and fallen leaves could be

increased the soil fertility, besides, some root system of trees could fix nitrogen in the soil.

10.1.2.3 Analyses of Impact on Sensitive Habitat and Proposed Mitigation Measures

All afforestations of this project are far away from the natural forest, natural reserve and the ecological public welfare forest region, and also cultural relics are not involved. So there is no adverse effect on wild animals and plants as well as cultural relics.

10.1.2.4 Impact of Land Occupation and Proposed Mitigation Measures

The proportion of the permanent occupation land is very small to total project areas. The temporary occupation, such as land forest road construction and so on, is also lower than the 0.5% of afforestation area. With non-forest wasteland, the influence of land occupation is small to land resource using of this project.

10.1.2.5 Risk Assessment and Prevention Measures

There are fire disaster and insect pest risks in forest, so the prediction and prevention of forest fire disaster and insect pest should be well done throughout the entire process of the project.

10.1.3 Social Impact Analyses and Proposed Mitigation Measures

10.1.3.1 Related Stakeholders

The employment opportunities would be provided for the peripheral region farmers (herdsmen, forest workers) which income could be increased. And also their production living condition and quality of life could be improved. Subsequently, the public infrastructure condition would be improved by the matching facilities' construction of the project area. And it would drive the region social economy development. Therefore, the village collective, the local forestry Department and so on would profit by participating in the project.

The ability requirement of forest management and the working strength of all levels of forestry departments, project related departments and villagers will have been

increased by implementation of this project. Therefore, it is necessary to complete the training and the technical guidance works of the relative personnel. And then the related necessary management measures should keep pace with progress of the project, and enlarge to propagandize the knowledge of carbon sequestration afforestation and its relative property.

10.1.3.2 Land Tenure

The afforestation lands of the project are all belong to the country or the collective, so there are not the problems on land ownership transfer.

10.1.3.3 Displacement of People

There isn't physical and economic displacement of people as a result of the project. External population was likely to settle in the project area owing to the social and economic benefits. Under the condition of permitting immigration by local government, employment opportunity will be provided to them.

10.1.3.4 Rights of Vulnerable Groups

The vulnerable groups in project areas mainly have women, impoverished communities, impoverished peasants and minorities. The employment opportunities may be provided during the implementation of the project for the women, and it is helpful in improving women's status in family. The massive employment opportunities and the considerable incomes would be provided to poor farmer households, and it could reduce their poverty in a certain extent. Moreover, the minorities and the Han Nationality enjoy the equal right and opportunities in the project. They could also obtain employment opportunities and the considerable incomes.

10.1.3.5 Problems of Permanent Worker and Seasonal Worker

The project would employ villagers nearby as seasonal and permanent workers. Their basic needs such as diet and lodging could be solved in themselves or neighbor villages. Therefore, the health and safety of workers would not be threatened by the project.

Chemical pesticide will be used during the reservation process, which could pollute

the source of drinking water, and indirectly threaten to the workers' health and security. So biological pesticides and biological methods should be adopted to reduce the use of pesticides as much as possible.

The workers possibly could not obtain the wage and bonus timely. The related departments should manage contractors strictly, so as to put an end to occurrence of defaulting the wage and bonus of seasonal workers and permanent workers.

10.2 Recommendations

10.2.1 Follow-up Program

The follow-up program of the project mainly has the following aspects:

- (1) Supervise the implementation and operation of the project.
- (2) Entrust the local environment protection monitor department to monitor the relative environment quality index during the implementation and operation of the project.
- (3) Organize and inspect the realization of each measure of the project by IMFA and each Banner (County or Distinct) Forestry Bureau.
- (4) Entrust Institutions with Corresponding qualification to carry out the works of CDM examination and registration, and carbon sequestration monitoring, verification, measurement, certification, and trading.
- (5) Certify forest products produced in this project, strengthen the marketing of forest products, and standard forest products market.
- (6) Help the contractor to formulate the reasonable forest management, the forest product sale plan and repayment schedule.

10.2.2 Further Suggestions and Environmental Requirements

For give full play in benefits, further suggestions would be suggested as followings:

- (1) This project sites locates at the desertification region with fragile ecological

environment. The destroyed original vegetation might be hardly restored by the implementation of the new project, and the original vegetation must be protected.

(2) The irrigation water required by the project is the mechanical and electrical well or the rivers existing nearby. Water resources are also precious in the arid area although it is richer in Tongliao City relatively. It is very difficult to restore once the water resources has been destructed. Therefore, the balance of water resources must be paid attention, and water resources monitoring would be suggested to carry on.

(3) It is suggested that the study on forest carbon sequestration should be strengthened, as well as a special study on the monitoring and calculation of forest carbon sequestration.

(4) It is suggested that the propaganda and training work of environmental protection should be strengthened, and the environmental awareness of the managers all levels and the farmers (herdsman, forest worker) should be enhanced to do the environmental protection work self-consciously.

(5) To provide the employment opportunity for the impoverished peasant household, increase their incomes, and lead the development of local economy, the impoverished community should be considered during the forest road construction in implementation phase of the project as far as possible.

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