CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM FOR SMALL-SCALE AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-SSC-AR-PDD)
(Version 02)

CONTENTS

**PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES
(CDM-SSC-AR-PDD) - Version 02**

SECTION A. General description of the proposed small-scale A/R CDM project activity:

A.1. Title of the proposed small-scale A/R CDM project activity:

>> Small-scale Afforestation for Desertification Combating at Kangping County, Liaoning Province, China.

Version 1.0

Date: 10/11/2007

A.2. Description of the proposed small-scale A/R CDM project activity:

>> The proposed A/R CDM project planned to establish 387.8 ha of shelter forest in Zhangjiayao Forestry Farm in the northwest of Kangping County of Liaoning Province, P.R. China. 104.9 ha of poplar plantation has been established since the year 2003, including 61.2 ha in 2003, 23.8 ha in 2004, 9.5 ha in 2005, 5.6 ha in 2006 and 4.8 ha in 2007. Another 282.9 ha will be established in the year 2008-2012.

The proposed small scale A/R CDM project activity is located in the southern fringe of the Kerqin Desert. The project area has been suffering from wind erosion and land desertification, and is one of areas most severely threatened by desertification and sand storm. The desertified lands is up to 160,000 hectare, amount to 73.6% of the total area in the County. Moreover, the Kerqin Desert is extending 100 meter southward annually and the desertified land area in Kangping County is increasing 3.3 km^2 annually. Due to unfavourable arid climate, poor soil conditions, wind erosion, desertification and lack of additional income, the local people live far below the national poverty level. Therefore, the operating entity (Zhangjiayao Forest Management Company Ltd) hold a view that the shelter forests established or to be established in the proposed small-scale A/R CDM project activity will help prevent wind erosion, alleviate desertification thus improve local living environmental conditions. Furthermore, the forests will sequester carbon in a manner that is compliant with the Clean Development Mechanism of the Kyoto Protocol, or that can be sold on the carbon market, thereby earning the project participants some extra income while benefiting the global environment. Therefore, the proposed small-scale A/R CDM project activity will not only control sand wind erosion as well as desertification, but also bring additional economic benefits, as a result contribute to sustainable development.

In the proposed small-scale A/R CDM project activity, the operating entity will invest in planting activities and manage the plantations during the crediting period, and own the carbon credit from the plantation.

A.3. Project participants:

>>

Table A-1 Project participants

Name of Party involved (*) ((host) indicates a host Party)	**Private and/or public entity(ies) project participants (*)** (as applicable)	**Kindly indicate if the Party involved wishes to be considered as project participant** (Yes/No)
People's Republic of China	Private entity: Zhangjiayao Forest Management Company Ltd, Kangping County, Liaoning Province, P.R. China	No
Japan	Private entity: Keio University, Japan	No
(*) At the time of making the CDM-SSCAR-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Description of location and boundary of the small-scale A/R CDM project activity:

>>

A.4.1. Location of the proposed small-scale A/R CDM project activity:

>>

A.4.1.1. Host Party(ies):

>> P. R. China

A.4.1.2. Region/State/Province etc.:

>> Liaoning Province

A.4.1.3. City/Town/Community etc:

>> Lands planted or to be afforested are located at Zhangjiayao Forestry Farm in the northwestern Kangping County.

A.4.2. Detail of geographical location and project boundary, including information allowing the unique identification(s) of the proposed small-scale A/R CDM project activity:

>> The proposed small-scale A/R CDM project activity is located in Kangping County in the north fringe of Liaoning Province, China. Kangping County, 42°31′-43°02′N and 122°45′-123°37′E, is bordered Inner Mongolia in the north and 120 kilometer north away from Shengyang City (Fig.A-1).

There are 21 parcels of lands within the project boundary, including 11 parcels of lands planted during 2003-2007 and 11 parcels of lands to be planted during 2008-2012. The geographical axis, measured using GPS, at each corner of the boundary of the lands planted or to be planted is listed in attached

spreadsheet (Annex 4), see also Fig.A-2 and Fig. A-3 below. The boundary maps are derived from GPS boundary and forest map of Kangping County in 1999 which was developed based on local forestry inventory.

Fig.A-1 Locations of the proposed small-scale A/R CDM project activity

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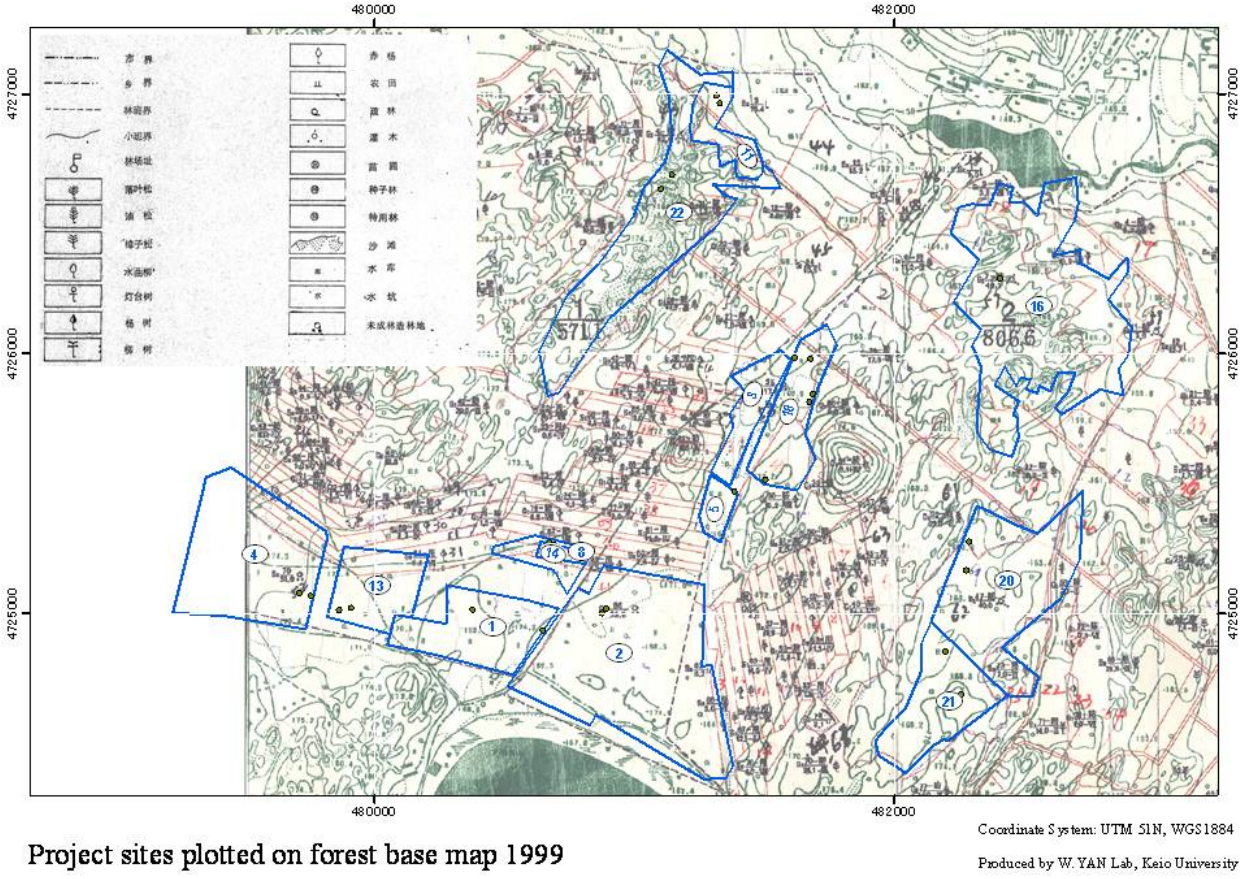
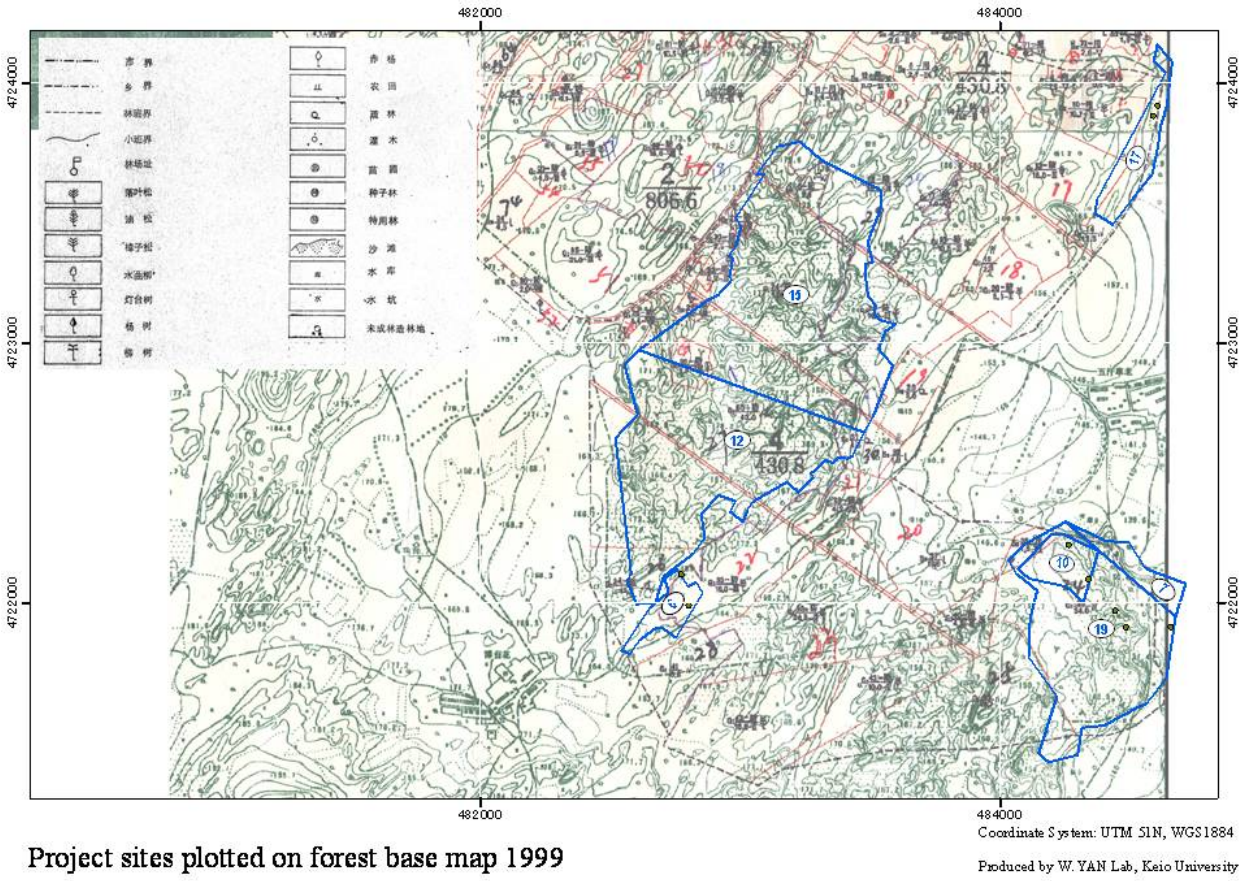
Fig.A-2 Location and boundary of project lands derived
from forest map in 1999 in the north part



Project sites plotted on forest base map 1999

Fig.A-3 Location and boundary of project lands derived from forest map in 1999 in the south part



Project sites plotted on forest base map 1999

A.5. Technical description of the small-scale A/R CDM project activity:

>>

A.5.1. Type(s) of small-scale A/R CDM project activity:

>> The project lands are severely desertified sandy land, covered with sparse grass and tiny shrubs. Occasionally the lands are cultivated for agricultural crop although the agricultural cultivation is illegal because the lands are legally defined for forestry purposes. Based on the Decision 6/CMP.1 "Simplified modalities and procedures for small-scale afforestation and reforestation project activities under the clean development mechanism in the first commitment period of the Kyoto Protocol and measures to facilitate their implementation"[1], the proposed small-scale A/R CDM project activity belongs to the type of grassland/croplands to forested land.

A.5.2. A concise description of present environmental conditions of the area, which include information on climate, soils, main watershed, ecosystems, and the possible presence of rare or endangered species and their habitats:

>> The project area is located at the west of Liaohe River Plain, with elevation above sea level around 76-100 m, inclined from southwest to northeast. The environmental conditions of the project area are summarized as follows[2]

Climate

Climate in the project area belongs to temperate continental monsoon climate, characterized by cold and few snow in the winter, drought and windy in the spring, warm and rainy in the summer.

The mean annual temperature is 6.9℃. The mean monthly temperature is 23.9℃ in July (hottest month) and -13.1℃ in January (the coldest month). Generally ,the air temperature rises above 0℃ in the mid March, around 5℃ in the late March or early April, around 10℃ in late April, and over 15℃ after early May. The air temperature decreases rapidly below 20℃ in the late August and early September. There are 169 days with daily mean temperature over 10℃. The extreme temperature is up to 36.5℃, occurred in May 28th 1965. Mean frost free day is 151 days.

The mean annual precipitation in the project area is 513.4 mm, with a highest at 801.4 mm in 1959 and lowest at 380.2 in 1967. The precipitation concentrates in July-September period accounting for 62% of the annual total. The highest daily precipitation was up to 128.5 mm occurred in July 4th 1959. The mean annual evaporation is 2018.2 mm, including 696.4 mm in May-June period accounting for 34%, and only 31.1 mm in January.

The mean annual sunshine hours in the project area is 2867.6 hours, including 289.6 hours in May, 236.8 hours in July, 246.2 hours in August and 256.9 hours in September.

The project area is windy. The mean annual wind speed is 4.6 m/s. It is 6.4 m/s in the spring (April-May) and 3.2 m/s in the summer (August). There is frequent gale in the spring with a wind speed up to 20 m/s

[1] FCCC/CP/2004/10/Add.2

[2] Kangping County Annals. 1995. Harbin: Northeast Forestry University Press

and the gale usually occurs 3 days consecutively once start. There are 30-40 days annually with wind speed over 8 degree, mostly in the spring. There is also gale in the autumn. The frequent gales in the spring and autumn jeopardize the Kharif.

As the project area is located at the southern fringe of the Kerqin Desert in addition to the strong wind in arid spring season, surface soil is subjected to bring away, resulting in sand storm and desertification. The desertified land and moving and semi-moving sand dune extend south ward from sever meters to tens of meters annually.

Soils

Soils in the project area are sandy soil developed from loess and aeolian material. Soil depth to impermeable layer is over 1 m. pH value is 8.2 - 8.6 for A horizon and 8.5 – 9.0 for B horizon. Soil depth is 30-70 cm.

Watershed

There are 8 rivers within Kangping County, with a total length of 218 km and a total watershed area of 2160 km^2. Among them Liaohe, 21.7 km in length, is the longest river. There are 14 reservoirs with a total volume of 250 million cubic meters. The Wolong Lake, with a total volume of 96.26 million cubic meters, is the second biggest freshwater lake in the northeast of China.

Ecosystems

The primitive vegetation has been destroyed completely. Current vegetation belongs to temperate forest steppe and meadow steppe of Mongolia flora. Typical species include elm, apricot, poplar, willow, *Cleistogenes sp, Setaria sp, Artemisia princeps, Puccinellia sp., Chrysosplenium sp., Elymus sp., Lespedeza bicolor*, etc. Planted species include *Pinus tabulaeformis, Pinus sylvestris var. mongolica, salix, populus sp, larix sp.*, etc.

Vegetation on project lands is dominated xerophil，including *Puccinellia sp., Cleistogenes sp*, et al.

Wildlife

Based on baseline survey, protected or endangered species and IUCN species have not been found on the proposed project lands. There is no nature reserve in the vicinity of the project area. These lands currently have very low biodiversity.

A.5.3. Species and varieties selected:

>> By consulting local forestry bureau at city and county level, interviewing, and taking into consideration carbon sequestration rates, soil and climate conditions, three poplar varieties have been chosen in the proposed small-scale A/R CDM project activity, i.e., Zhelin No.4 and Baicheng No.4

Zhelin No.4 is bred by the Tongliao Institute of Forestry, Inner Mongolia, in 1975. It is a hybrid of P. pseudo-simonii x P. nigra var.lica (female) and P. Canadensis (male). After 15 year's cultivation and demonstration, the Zhelin No.4 got a technological certification in 1991. It is now a recommended variety in Kerqin desert.

Baicheng No.4 is a natural hybrid of *Populus nigra* L. *var italica* (Duroi) Koehne and *populus simonii* in Baicheng Railway Forestry Farm, and was selected by Dr Kim et al. in the Baicheng Instituite of Forestry, Jinlin in 1961.

A.5.4. Technology to be employed by the proposed small-scale A/R CDM project activity:

>> To ensure successful afforestation, the following technical standards are strictly followed:

- State Technical Regulations for Afforesation/Reforestation: GB/T 15776-1995;
- State Technical Regulations for Establishing Eironmental Service Forests: GB/T 18337.1-2001, GB/T 18337.2-2001, GB/T 18337.3-2001;
- State Technical Regulations for Designing of Afforesation/Reforestation: LY/T 1607-2003;
- State Technical Regulations for Forest Management: GB/T 15781-1995;
- Standards for Seedling Qualification: GB 6000-1999;
- Technical Standard for Seedling Breading: GB/T 6001-1985;

The local forestry agencies, i.e., Forestry Bureau of Shengyang City and the Forestry Bureau of Kangping County have provided or will provide technical consultation and guidance, including training courses, and conduct quality control to the preparation and implementation of the proposed small-scale A/R CDM project activity. Project participants will also seek advice from other local, national, and international forestry experts.

Site and Soil Preparation

To reduce GHG emission and protect existing carbon stocks, site burning and overall tillage will not be employed during the site and soil preparation. Small holes (with diameter 40 cm and depth 60 cm will be dug). The site and soil preparation are usually conducted in the autumn.

Genetic Sources and Nursery Practices

Poplar seedlings used in the proposed small-scale A/R CDM project activity are produced on-sites beside the project lands. Poplar seedlings are cultured from clones which are collected and purchased from local poplar clone orchard. The clones used in the proposed small-scale A/R CDM activity have been used in the project region for many years.

Forest Establishment

Planting activities will last 10 years, starting in 2003. The spacing is 2m × 6m. The plan for forest establishment are listed in table A-2 below.

Table A-2 Specification for forest establishment

Planting time	Sub-component	Land ID	Area (ha)	Varieties

2003	70	1	13.6	Baicheng No.4
	86	2	41.1	Baicheng No.4
	25	3	6.5	Baicheng No.4
2004	70	4	23.8	Baicheng No.4
2005	25	5	2.3	Zhelin No.4
	41	6	3.6	Zhelin No.4
	39,44	7	3.6	Zhelin No.4
2006	70	8	1.1	Baicheng No.4
	39	10	4.5	Baicheng No.4
2007	4	11	4.8	Baicheng No.4
2008	24, 30, 34	12	44.3	Zhelin No.4
	70	13	9.7	Zhelin No.4
	70	14	3.8	Zhelin No.4
2009	24,30,34	15	58.3	Zhelin No.4
2010	7	16	42.1	Zhelin No.4
	14	17	6.3	Zhelin No.4
	25	18	10.1	Zhelin No.4
2011	39,44	19	37.3	Zhelin No.4
	47	20	24.2	Zhelin No.4
2012	47	21	12.6	Zhelin No.4
	4	22	34.2	Zhelin No.4
total			387.8	

To ensure high survival rates and good growth in the early stages, weed will be slashed manually twice (June and August) a year in the first 2 years and once in the third year after planting, Fertilization will not be applied to planted trees. To increase local income, agricultural intercropping was or will be conducted in the first three years.

Survival rates will be checked and re-planting will be conducted 1 month after planting if needed.

Forest Management

The forests established by the project will not be thinned, nor fertilization. It will be harvested in the 25-year-old. Re-planting will be conducted upon harvesting.

A.5.5. Transfer of technology/know-how, if applicable:

>>There is no technical transfer to the host parties.

A.5.6. Proposed measures to be implemented to minimize potential leakage as applicable:

>> The project lands are desertified sandy barren lands, with occasional pre-project illegal agricultural cultivation or sporadic illegal grazing on some parcels of lands. The lands are legally forestry lands. Leakage due to the displacement of the pre-project activities is hardly possible due to the governmental license control of tree logging, however, the proposed small-scale A/R CDM project activity will strictly enforce the Forest Laws and its related regulations, and avoid tree logging due to displacement of illegal

agricultural cultivation and grazing by control license issurance. Displacement leakage has not occurred due to the afforestation.

Potential leakage associated with the proposed small-scale A/R CDM project activity may be the use of vehicles for the transportation of products and seedlings. Although potential transportation leakage is relatively small and the methodology applied does not require to take into consideration of such leakage, the proposed small-scale A/R CDM project activity will make effort for vehicles to be full-loaded on both to and return ways so as to minimize the leakage.

A.6. A description of the legal title to the land, current land tenure and land use and rights to tCERs / lCERs issue:

>> The lands planted and to be planted in the proposed small-scale A/R CDM project activity are legally owned by state government and managed by Zhangjiayao Forestry Farm. All lands are barren before planting, with occasional pre-project illegal agricultural cultivation or sporadic illegal grazing on some parcels of lands.

To effectively promote and govern CDM project activities in China, the Chinese government issued the *Measures for Operation and Management of Clean Development Mechanism Projects in China* on Oct 12, 2005, effective immediately. Based on the *Measures*, the Chinese Government allows any sponsor to apply, invest in, and implement a CDM project activity as long as it meets basic requirements stipulated in the *Measures*. The right of access to tCERs belongs fully to participants after Chinese government taxes 2% of transfer value[3].

A.7. Assessment of the eligibility of land:

>> The Chinese Government defines forests as lands having growing trees with:

- A minimum area of 0.067 hectares;
- A minimum tree crown cover of 20%; and
- A minimum height of 2 meters.

Therefore, the threshold values of the forest definition of Chinese government comply with the UNFCCC definition and are to be used for the purposes of the Kyoto Protocol.

The land eligibility is demonstrated using latest version of "Procedures to demonstrate the eligibility of lands for afforestation and reforestation project activities (Version 01)"[4], as bellow.

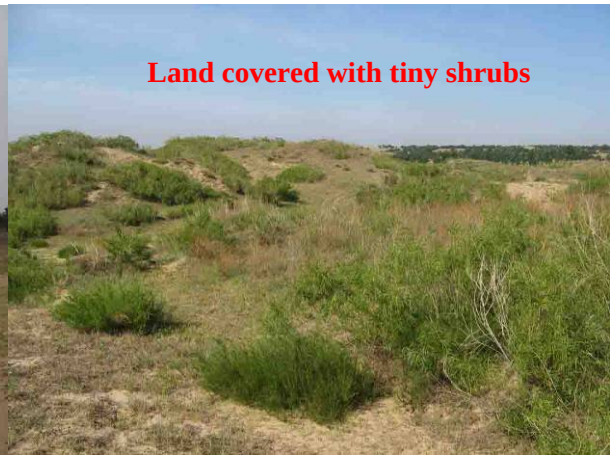
(a) The land at the moment the project starts is not a forest, which has been demonstrated by

(i) Field survey showed and interview with local communities that the lands to be planted in the proposed small-scale A/R CDM project activity are desertified lands occupied by sparse grass or tiny shrubs or sandy bare land, at the start of the project, rather than forests or young natural stands and plantations or temporarily unstocked lands that are expected to reach the minimum crown cover and minimum height chosen by China to define forest rather than forests or temporarily

[3] http://cdm.ccchina.gov.cn/

[4] http://cdm.unfccc.int/EB/Meetings/035/eb35_repan18.pdf

unstocked lands. Although there are pre-project living trees on some project lands, the crown cover is much more lower than 20% that is defined by the Chinese government for a forest (table C-2).



(i) Most recent land use/cover maps showed in figures above (Fig A-2 and Fig A-3) also demonstrates that the lands planted or to be planted are not forested lands. The maps were derived from national forestry inventory that has been conducting once every 5 years.

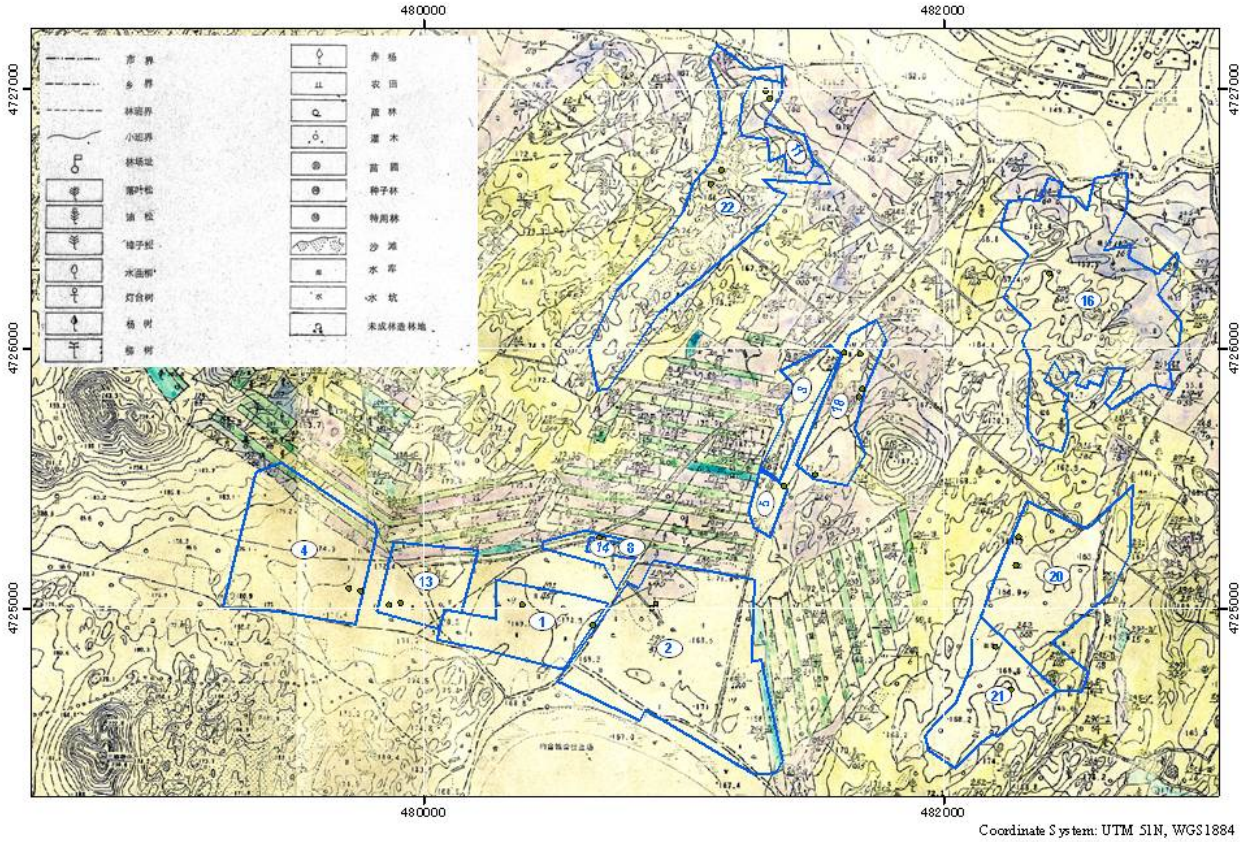
(b) The activity is an eligible CDM afforestation project activity, which is demonstrated by

(i) Interviewing with local forestry farmers/communities on land use/cover history and important events that have impacted the land use/cover showed that the lands to be planted in the proposed small-scale A/R CDM project activity have been non-forested lands at least 50 years ago.

(ii) Land use/cover maps showed in figures below (Fig A-4 and Fig A-5 below) also demonstrate that the lands to be planted were not forested lands in 1988.

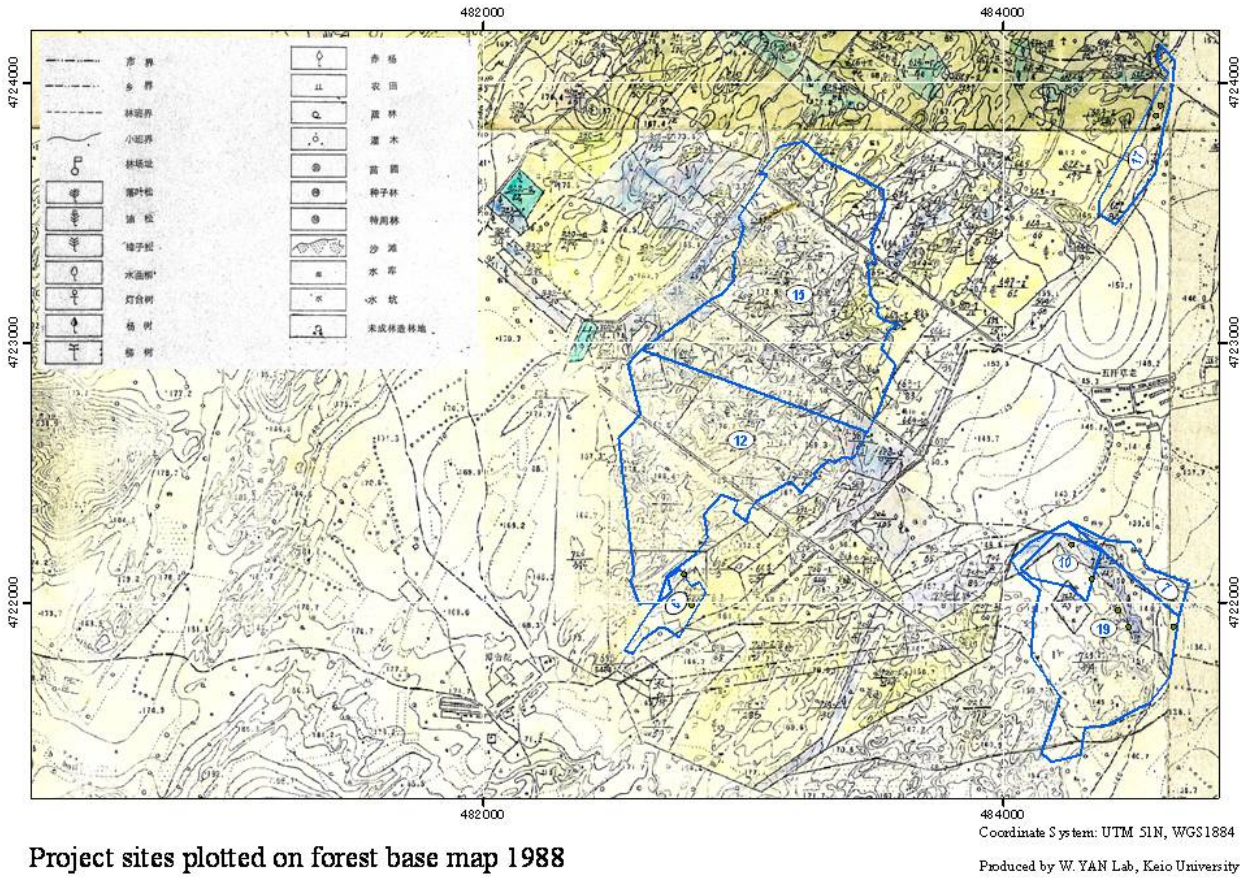
Note: The land use/cover maps will be accessible to the DOE to confirm the eligibility of lands. The lands planted or to be planted in the proposed small-scale A/R CDM project activity are marked with blue lines in these figures.

Fig. A-4 Land use/cover map in 1988 in the north part



Project sites plotted on forest base map 1988

Fig. A-5 Land use/cover map in 1988 in the south part



A.8. Approach for addressing non-permanence:

>> The issuance of tCER for the net anthropogenic GHG removals by sinks achieved by the proposed small-scale A/R CDM project activity is chosen.

A.9. Duration of the proposed small-scale A/R CDM project activity / Crediting period:

>>

A.9.1. Starting date of the proposed small-scale A/R CDM project activity and of the (first) crediting period, including a justification:

>>01/01/2003 is the starting date of the proposed small-scale A/R CDM project activity and the first crediting period because the planting activity started in 2003.

A.9.2. Expected operational lifetime of the proposed small-scale A/R CDM project activity:

>> 40 years 0 month.

A.9.3. Choice of crediting period and related information:

>>20 years 0 month renewable

A.9.3.1. Duration of the first crediting period (in years and months) if a renewable crediting period is selected:

>>20 years 0 months.

A.9.3.2 Duration of the fixed crediting period (in years and months), if selected:

>>N/A

A.10. Estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period:

>> The net anthropogenic GHG removals by sinks as a result of the proposed small-scale A/R CDM project activity is anticipated to be a 22,477 tonnes of CO_2 equivalent during the crediting period (between January 01, 2003 and December 31, 2022) per the Table A-3 below.

Table A-3 Ex ante estimated net anthropogenic GHG removals by sinks

Please provide the total estimation of net anthropogenic GHG removals by sinks as well as annual estimates for the chosen crediting period. Information on the net anthropogenic GHG removals by sinks shall be indicated using the following tabular format.	
Years	Annual estimation of net anthropogenic GHG removals by sinks in tonnes of CO2 e
2003	-1,066
2004	-4
2005	-4
2006	-4
2007	-3
2008	1
2009	14
2010	46
2011	106
2012	207
2013	358
2014	567
2015	845
2016	1,202

2017	1,653
2018	2,206
2019	2,867
2020	3,629
2021	4,477
2022	5,382
Total estimated net anthropogenic GHG removals by sinks (tonnes of CO2 e)	22,477
Total number of crediting years	20
Annual average over the crediting period of estimated net anthropogenic GHG removals by sinks (tonnes of CO2 e)	1124

Notes: minus sign indicates the source while plus indicates the sink

A.11. Public funding of the proposed small-scale A/R CDM project activity:

>> There is no available public funding that will result in a diversion of official development assistance and financial obligations of any Parties under UNFCCC.

A.12. Confirmation that the small-scale A/R CDM project activity is not a debundled component of a larger project activity:

>> There is no registered small-scale A/R CDM project activity and no application to register another small-scale CDM project activity that conform to criteria for determining the occurrence of debundling[5]:

(a) with the same project participants;

(b) Registered within the previous two years;

(c) Whose project boundary is within 1 km of the project boundary of the proposed small-scale A/R CDM activity at the closest points.

Therefore the proposed small-scale A/R CDM project activity is not a debundled component of a larger project activity.

SECTION B. Application of a baseline and monitoring methodology :

B.1. Title and reference of the approved baseline and monitoring methodology applied to the proposed small-scale A/R CDM project activity:

>> Latest revised approved methodology "Revised simplified baseline and monitoring methodologies for selected small-scale afforestation and reforestation project activities under the clean development

[5] Appendix C in Decision 6/CMP.1

mechanism implemented on grasslands or croplands"(AR-AMS0001/Version 04.1)[6] was applied to the proposed small-scale A/R CDM project activity.

B. 2. Justification of the applicability of the baseline and monitoring methodology to the proposed small-scale A/R CDM project activity:

>> The proposed small-scale A/R CDM project activity complies with the applicability conditions under which the chosen baseline and monitoring methodology is applies (Section I.1 in the chosen methodology) in the following ways:

(a) project activities are implemented on grasslands/croplands: The lands planted or to be planted in the proposed small-scale A/R CDM project activity are desertified lands covered with sparse grass and sporadic tiny shrubs, with occasional illegal agricultural cultivation or illegal grazing;

(b) project activities are implemented on lands where the area of the cropland within the project boundary displaced due to the project activity is less than 50 per cent of the total project area: The project lands are desertified lands. Although there are occasional agricultural cultivation on some parcels of lands, but they are legally forestry lands rather than cropland, thus the displacement of agricultural cultivation unlikely occurs;

(c) project activities are implemented on lands where the number of displaced grazing animals is less than 50 per cent of the average grazing capacity of the project area: The project lands are desertified lands. Although there are sporadic grazing on some parcels of lands, but they are legally forestry lands rather than grazing land, thus the displacement of grazing unlikely occurs;

(d) project activities are implemented on lands where $\leqslant$ 10% of the total surface project area is disturbed as result of soil preparation for planting: The Small holes (with diameter 40 cm and depth 60 cm) will be dug during site preparation. Digging 833 holes per hectare of such hole will result in 105 m^2 per hectare to be disturbed, amount to 1.05% of the total surface project area.

B. 3. Specification of the greenhouse gases (GHG) whose emissions will be part of the proposed small-scale A/R CDM project activity:

>> The only GHG emission as part of the proposed small-scal A/R CDM project activity is the vehicle use. Based on the methodology applied, project emissions to be taken into account (ex-ante and ex-post) are limited to emissions from the use of fertilizers. The proposed small-scale A/R CDM project activity did not or will not apply fertilizer, thus no GHG emissions will be accounted.

B. 4. Carbon pools selected:

>> Based on the methodology applied, carbon pools to be considered by the proposed small-scale A/R CDM project activity are above- and below-ground tree biomass. Due to the desertification and degrading feature and occasional agricultural cultivation, both the living biomass of both sporadic tiny shrub and underground biomass of grass are in degrading or steady-state, thus their carbon stock changes can be conservatively omitted.

[6] http://cdm.unfccc.int/UserManagement/FileStorage/IRG4EK84S3V1AJWF6X2AEJWS8HKGJ4

Table B-1 Carbon pools selected

Carbon pools	Selected (answer with yes or no)
Above ground	Yes
Below ground	Yes
Litter	No
Dead wood	No
Soil organic carbon	No

B.5. Description of strata applied for ex ante estimations:

>> The procedures in paragraph II.7 of the methodology applied have been followed for the stratification for purpose of baseline calculation. Due to the severe desertification that the project lands suffered and are suffering, as well as occasional illegal agricultural cultivation and grazing, the lands are degraded and degrading. The carbon stocks both in the living biomass pool of woody perennials and in below-ground biomass of grasslands expect to decrease in the absence of the proposed small-scale A/R CDM project activity, and can be conservatively assumed to be zero. Based on pre-project vegetation, the project lands have been stratified into three baseline strata (table B-2). The pre-project vegetation types have been determined by satellite images before planting, followed by field verification and interview. The baseline stratification was then developed on GIS platform (Fig B-1)

Table B-2 Baseline Stratification

Baseline strata ID	Vegetation	Area (ha)
BLS-1	grassland	113.8
BLS-2	shrubland	196.1
BLS-3	Sandy bareland	77.9
Total		387.8

Based on the applied methodology, for the purpose of the ex-ante calculation of the project biomass, the project area has been stratified according to the project planting plan, i.e., planting year and tree species (varieties) as shown in Table B-3.

Table B-3 Stratification for ex ante estimation of project carbon stock changes

project strata ID	Planting time	Sub-component	Land ID	Area (ha)	Varieties
Proj-1	2003	25, 70, 86	1-3	61.2	Baicheng No.4
Proj-2	2004	70	4	23.8	Baicheng No.4
Proj-3	2005	25,41,39,44	5-7	9.5	Zhelin No.4
Proj-4	2006	39,70,lowland	8-10	5.6	Baicheng No.4
Proj-5	2007	4	11	4.8	Baicheng No.4
Proj-6	2008	24, 30, 34,70	12-14	57.8	Zhelin No.4
Proj-7	2009	24,30,34	15	58.3	Zhelin No.4
Proj-8	2010	7,14,25	16-18	58.5	Zhelin No.4
Proj-9	2011	39,44,47	19-20	61.5	Zhelin No.4
Proj-10	2012	4,47	21-22	46.8	Zhelin No.4
total				387.8	

Fig. B-1 Baseline stratification map

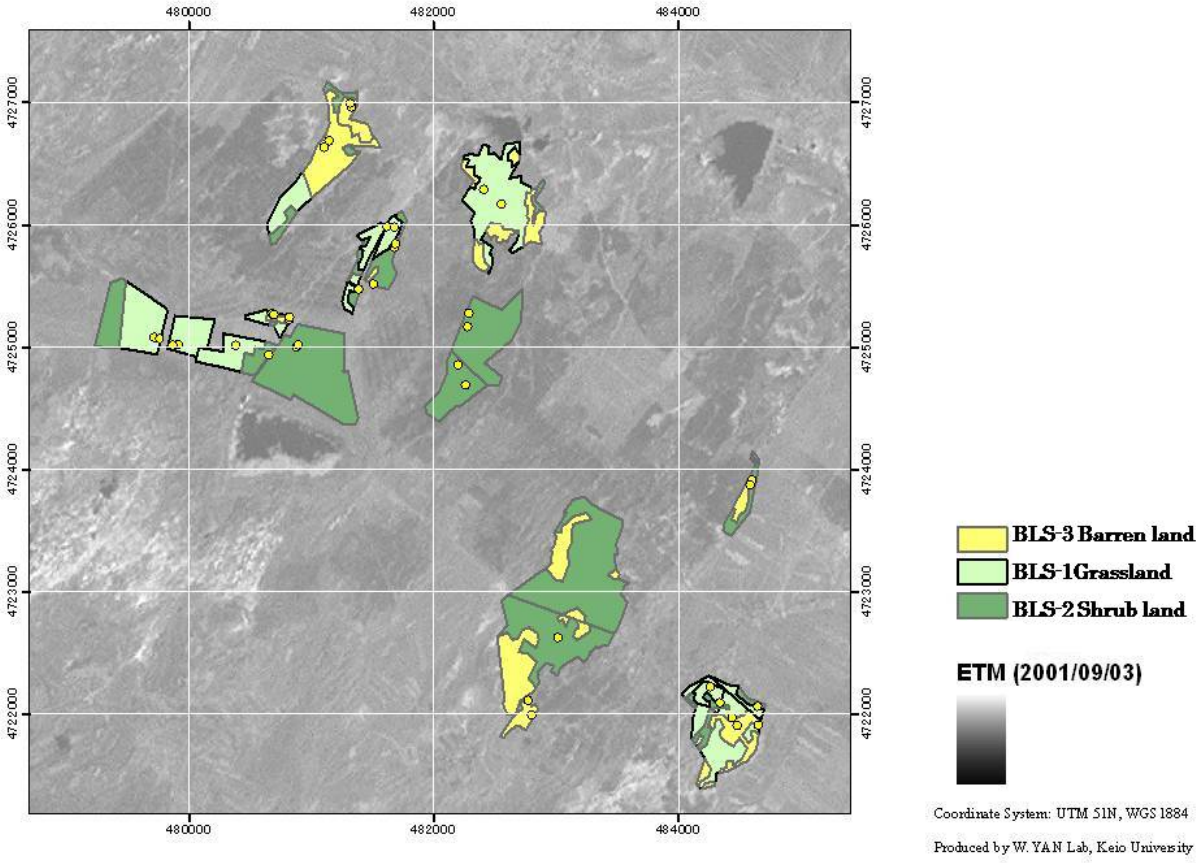
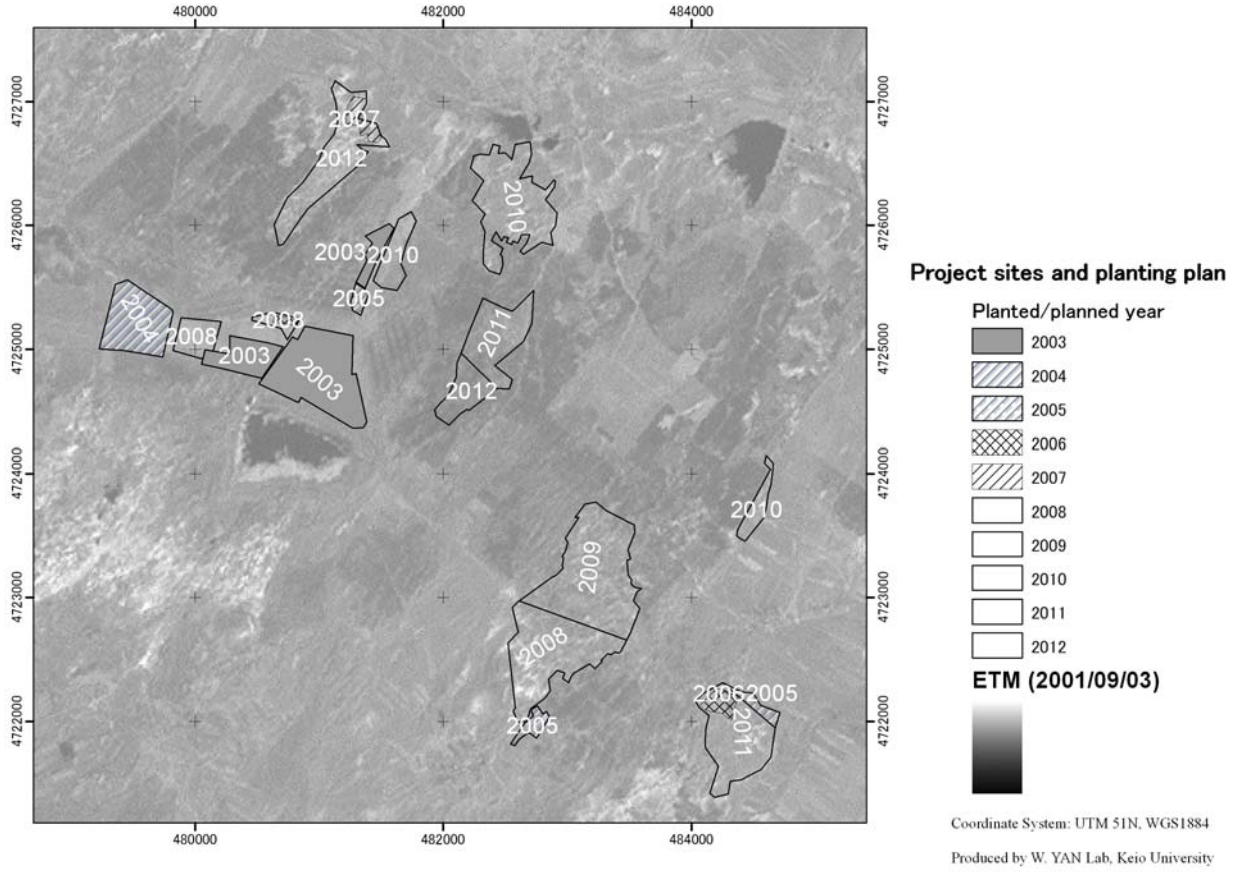


Fig. B-2 Project stratification map



B. 6. Application of baseline methodology to the proposed small-scale A/R CDM project activity:

>> Due to the impact of the desertification, sand erosion as well as illegal agricultural cultivation or grazing, the project lands have been degraded and will continue to degrade in the absence of the proposed small-scale A/R CDM project activity. The most likely baseline scenario of the proposed small-scale A/R CDM project activity is considered to be the land-use prior to the implementation of the project activity, i.e., desertified lands covered with sparse grass and sporadic tiny shrub, with occasional illegal agricultural cultivation or illegal grazing. The carbon stock in the living biomass pool of woody perennials and grasslands is expected to decrease in the absence of the proposed small-scale A/R CDM project activity, and is assumed to be zero. However due to the continuous growth of the pre-project trees in the baseline scenario, the baseline net GHG removals by sinks is calculated as the increase in carbon stock in living biomass of the pre-project living trees. In the above case, the baseline carbon stocks in the carbons pools equal to existing carbon stocks at the start of the project activity (see Section C.1 below for detail calculation).

B. 7. Description of how the actual net GHG removals by sinks are increased above those that would have occurred in the absence of the registered small-scale A/R CDM project activity:

>> The lands afforested and to be afforested within the project boundary are desertified lands occupied with a sparse grass and tiny shrubs. The most likely baseline scenario of the proposed small-scale A/R CDM project activity is considered to be the land-use prior to the implementation of the project activity, because:

- Investment Barriers (assessed the additionality using the tool contained in Appendix B of the approved methodology applied)
  - ✓ Lack of access to credit: No credit mechanisms are in place for the forestry farm to make long term investment in plantation forestry. Income per household was only 2000-3000 Yuan RMB (US$ 266~400) in 2006, with 3-5 family members each household. The income is mainly from agricultural cultivation, forest by-product such as mushroom. Under this situation, local forestry farmers still live below the poverty level[7]. Due to the poverty in this region, local communities are not able to afford the high plantation establishment investment in the early stage, because all incomes from wood and non-wood products will occur quite some time after the initial investment.
  - ✓ Debt funding not available for this type of project activity: There is no chance to get commercial loans from banks for the purpose of afforestation in the project area due to high risk and the economical unattractiveness in the context of desertified lands.
  - ✓ The forestry farm is financially independent accounting enterprise without any government subsidy. Due to the unfavorable climate and soil conditions, forest resource is very limited and forest productivity is very low. The limited income from timber and non-wood product even can not afford to the operation of the forestry farm including the salary.

  The identifiable investment barriers described above prevent investors or the forestry farms from using the land in a manner that will lead to forest, i.e., the lands afforested and to be afforested, in the absence of the proposed small-scale A/R CDM project activity, will continue as they were.
- Land use surveys show that similar lands in the vicinity are not being converted to any other land use. Because of lacking investment and no policy support, the land owners have no motivation to convert the land to forest. The field surveys and interviews with forestry farmers indicated that the only realistic and credible alternative available to the project participants is to continue the barren land.
- In all cases the natural regeneration would not occur in the absence of the proposed small-scale A/R CDM project activity due to:
  - ✓ Long-term desertification and occasional agricultural cultivation have resulted in the complete loss of seed pool of trees;
  - ✓ A field study took place within these parcels and no tree seedlings were found.

Carbon dioxide will be sequestered from the atmosphere through the growth of planted trees and stored in the aboveground biomass and belowground biomass of living trees. In the project scenario, 833 trees per hectare will be planted, resulting in much higher carbon stock change in living biomass than in the

[7] The criteria for determining national poverty level is 2,700 RMB (about 340 US$) GDP per capita for people living in remote areas or for ethnic groups (State Council. 1996. List of national poverty counties).

baseline scenario. It can also be demonstrated that the increase in GHG emission is negligible. Therefore the actual net GHG removals by sinks will be increased above those that would have occurred in the absence of the registered small-scale A/R CDM project activity.

See section C for detailed methods and ex ante estimation of baseline net removals by sinks and actual net GHG removals by sink.

B.8. Application of monitoring methodology and monitoring plan to the small-scale A/R CDM project activity:

>>

a. Ex post estimation of the baseline net greenhouse gas removals by sinks

As described in the approved small-scale A/R CDM methodology applied, the baseline will not be monitored. The baseline net GHG removals by sinks will be assumed to be those estimated in section C.1 below**.**

b. Ex post estimation of the actual net greenhouse gas removals by sinks

The project participants will determine any changes in carbon stocks via measuring and monitoring the project area that has been planted. The project boundary will be monitored and carbon sampling will take place within stratified sample plots. All sampling to take place will be in accordance with the methods described in 4.3.3.4 of the IPCC GPG for LULUCF. This monitoring plan will be used throughout the project area and the crediting period. If carbon stocks in some areas differ significantly from those in same strata, these areas will be assessed as a separate stratum.

The sample frame used will determine the number of plots needed in each stratum to reach the targeted precision level of about ±5% of the mean at the 95% confidence level in a cost-effective manner. GPS located plots ensure the measuring and monitoring consistently over time.

The carbon stocks will be estimated through stratified random sampling procedures and using the following equations (equation 24 in the monitoring methodology applied)**:**

$$P_{(t)} = \sum_{i}^{I} (P_{A(t)i} + P_{B(t)i}) \cdot A_i \cdot (44/12) \qquad \text{(B.1)}$$

where:

$P_{(t)}$	carbon stocks within the project boundary at time *t* achieved by the project activity (t CO_2-e)
$P_{A(t)i}$	carbon stocks in above-ground biomass at time *t* of stratum *i* achieved by the project activity during the monitoring interval (t C/ha)
$P_{B(t)i}$	carbon stocks in below-ground biomass at time *t* of stratum *i* achieved by the project activity during the monitoring interval (t C/ha)
A_i	project activity area of stratum *i* (ha)
i	Stratum *i* (I = 10, the total number of strata)

Sampling to estimate these carbon stocks will take place under the following method:

b.1 Stratification of the project area

The project lands are relative homogeneous in terms of climate, soil, vegetation and other environmental conditions. The planting density is identical and the variety planted in same year is also same. Therefore, the proposed project area was stratified into 10 strata based on planting time. Each stratum represents one planting year (please see Table B-3).

However, post stratification will be conducted after the first monitoring event to address the possible changes of project boundary and planting timing in comparison with the project design, and to address the change in carbon stocks more or less variable than that is expected. Following factors will be considered in the post-stratification:

- Data from monitoring of forest establishment and project boundary, e.g., project boundary, and planting year that occur actually;
- Data from monitoring of forest management, e.g., thinning and harvesting that occur actually;
- Variation in carbon stock change for each stratum after the first monitoring event.

b.2 Sampling Frame

Permanent sampling plots will be established for sampling over time to measure and monitoring carbon stocks of the relevant carbon pools. The plots will be treated in the same way as other lands within the project boundary, e.g., during site and soil preparation, weeding, etc., and will be prevented from being deforested over the crediting period.

b.2.1 Determining sample size

The precision target for monitoring will be ±10% at a 95% confidence level of the mean. In the proposed small-scale A/R CDM project activity, the number of samples plots for each stratum and the project as a whole will be estimated using the following equation (5) and (6) in the draft methodological tool "Calculation of the number of sample plots for measurements within A/R CDM project activities" approved by EB[8]:

$$n = \frac{\left(\sum_{i=1}^{L} N_i * st_i\right)^2}{\left(\frac{N \cdot E}{z_{\alpha/2}}\right)^2 + \left(\sum_{i=1}^{L} N_i * (st_i)^2\right)} \qquad \text{(B.2)}$$

[8] http://cdm.unfccc.int/EB/Meetings/031/eb31_repan15.pdf

$$n_i = \frac{\sum_{i=1}^{L} N_i * st_i}{\left(\frac{N \cdot E}{z_{\alpha/2}}\right)^2 + \sum_{i=1}^{L} N_i * (st_i)^2} \qquad \text{(B.3)}$$

$$N = \frac{A}{AP} \qquad N_i = \frac{A_i}{AP} \qquad \text{(B.4)}$$

$$E = Q \cdot p \qquad \text{(B.5)}$$

where:

n	sample size (total number of sample plots required) in the project area
n_i	sample size for stratum i
E	allowable error of the estimated quantity Q
i	i = 1, 2, 3, … L project strata
L	total number of strata; dimensionless
α	α = 1-α is probability that the estimate of the mean is within the error bound E
$z_{\alpha/2}$	$z_{\alpha/2}$ = value of the statistic z (embedded in Excel as: inverse of standard normal probability cumulative distribution), for e.g. 1-α = 0.05 (implying a 95% confidence level) $z_{\alpha/2}$=1.9599
N_i	maximum possible number of sample plots in stratum i
N	maximum possible number of sample plots in the project area
st_i	standard deviation for each stratum i; dimensionless
A	total size of all strata, e.g. the total project area; ha
A_i	size of each stratum i; ha
AP	sample plot size (constant for all strata); ha
Q	approximate average value of the estimated quantity (aboveground wood volume per hectare); m^3 ha^{-1}
p	desired level of precision (10%); dimensionless

b.2.2 Randomly locating sampling plots

Plot locations will be randomly and evenly distributed throughout the project area using a GIS script. Permanent sample plots with documented GPS coordinates will be established. The size of plots is 600 m^2 (30m × 20m).

b.3 Measuring and estimating carbon stock changes over time

The growth of individual trees on plots shall be measured at each time interval. The diameter at breast height (DBH) and height of each tree will be measured during each monitoring period. The carbon stock in the tree biomass will then be estimated based on stem volume, a nationally developed biomass expansion factor, root-shoot ratio and local wood density.

Step 1: Measuring the diameter at breast height (DBH, at 1.3 m above ground) and height of all the trees in the permanent sample plots above a minimum DBH (2 cm).

Step 2: Estimating the stem volume of trees based on following equation[9]:

$$SV_{tree} = 0.268538427 DBH^2 \cdot H + 0.00552845 D \cdot H + 0.560172171 D^2 \quad \text{(B.6)}$$

$$SV = \sum_{1}^{NT} SV_{tree} \cdot \frac{10000}{600} \quad \text{(B.7)}$$

Where:

SV_{tree}	stem volume of single tree, cubic meter ($m^3.tree^{-1}$)
DBH	diameter at breast height, metre (m)
H	tree height, meter (m)
SV	stem volume of tree, cubic meter ($m^3.ha^{-1}$)
NT	Number of trees within measuring plot, $trees.plot^{-1}$

Step 3: Choosing BEF, wood density, root-shoot ratio (R) and other parameters: Parameters from China's Initial National Communication for Land Use Change and Forestry Sector are used in the estimation (Table B-1).

Table B-1 WD, BEF and R for species used in the proposed small-scale A/R CDM project activity[10]

Tree species	Wood density (tonnes d.m.m^{-3} stem volume)	BEF	Root-shoot ratio （R）
Poplar	0.378 (144, 0.009)	1.59 (108, 0.03)	0.291 (107, 0.012)

Note: data in parentheses represent number of samples and standard error respectively

Step 4: Calculating aboveground biomass via the stem volume, basic wood density, BEF, given by equations (26) of the approved small-scale A/R CDM methodology applied:

[9]Zhao T. and Chen Z. (eds). 1994. Intensive management of poplar plantation. Beijing: China Science and Technology Press.

[10] Institute of Forest Ecology and Environment, CAF, database and report of the GHG Inventory in Forestry Sector,2005.

$$E_{(t)i} = SV_{(t)i} \cdot BEF \cdot WD \quad \text{(B.8)}$$

where:

$E_{(t)i}$	estimate of above-ground biomass at time *t* for stratum *i* achieved by the project activity (t dm.ha^{-1})
$SV_{(t)i}$	stem volume of trees at time *t* for stratum *i* achieved by the project activity , cubic meter (m^3.ha^{-1})
WD	basic wood density (t d.m. m^{-3})
BEF	biomass expansion factor from stem to aboveground biomass (dimensionless)

Step 5 Calculating above- and below-ground carbon stock in living biomass

$$P_{A(t)i} = E_{(t)i} \cdot 0.5 \quad \text{(B.9)}$$

$$P_{B(t)i} = E_{(t)i} \cdot R \cdot 0.5 \quad \text{(B.10)}$$

where:

0.5	=carbon fraction of dry matter (t C/t dm)
R	=root to shoot ratio (dimensionless)

c. Ex post estimation of leakage

As described in the approved small-scale methodology applied, the possibility of leakage from the displacement of activities will be monitored at each monitoring period in the project area. However, since the lands within the project boundary are desertified lands occupied with a sparse grass and tiny shrub, with only occasional illegal agricultural cultivation and grazing, the activity displacement is unlikely to occur. Therefore:

$$L_{tv} = 0 \quad \text{(B.11)}$$

Where

L_{tv}	total GHG emission due to leakage at the time of verification (t CO_2-e)

d. Ex post estimation of the net anthropogenic GHG removals by sinks

The estimated temporary certified emission reductions (tCER) at the year of verification will be calculated as described in the approved small-scale A/R methodology section IV.D equation (33)-(34):

e. Monitoring frequency

The planting activity is conducted from 2003 to 2012. The project and permanent sample plots will be monitored every five years, i.e., 2012, 2017, 2022, the end of the crediting period.

f. Data collection

Data collection will be organized taking into account the carbon pools measured, the sample frame used and the number of permanent plots to be monitored in accordance with the section on quality assurance/quality control (QA/QC) below.

g. Quality control and quality assurance

A quality control, quality assurance (QA/QC) plan has been developed and will become a part of project documentation (see section B.8.2).

B.8.1 Data to be monitored: Monitoring of the actual net GHG removals by sinks and leakage.

B.8.1.1. Actual net GHG removals by sinks data:

B.8.1.1.1. Data to be collected or used in order to monitor the verifiable changes in carbon stock in the carbon pools within the project boundary resulting from the proposed small-scale A/R CDM project activity, and how this data will be archived:

Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
Location of the areas where the project activity has been implemented	*Field survey or cadastral information or satellite imagery*	*Latitude and longitude*	*Measured*	*5*	*100 percent*	*Electronic, paper, photos*	*GPS can be used for field survey*
Ai - Size of the areas where the project activity has been implemented for each type of strata	*Field survey or satellite imagery or GPS*	*ha*	*Measured*	*5*	*100 percent*	*Electronic, paper, photos*	*GPS can be used for field survey*
Location of the permanent sample plots	*Project maps and project design*	*Latitude and longitude*	*Measured*	*5*	*100 percent*	*Electronic, paper*	*Using GPS to locate at time of each field measurement*
Diameter of tree at Breast Height *(1.30m)*	*Plot measurement*	*cm*	*Measured*	*5*	*Each tree in the sample plot*	*Electronic, paper*	*Measure diameter at breast height (DBH) for each tree that falls within the sample plot and applies to*

							size limits
Tree height	*Plot measurement*	*m*	*Measured*	*5*	*Each tree in the sample plot*	*Electronic, paper*	*Measure height (H) for each tree that falls within the sample plot and applies to size limits*
Basic wood density	*national LUCF inventory*	*tonnes of dry matter per m^3 fresh volume*	*estimated*	*once*		*Electronic, paper*	
Biomass expansion factor (BEF)	*national LUCF inventory,*	*dimensionless*	*estimated*	*once*		*Electronic, paper*	
Root-shoot ratio	*national LUCF inventory*	*dimensionless*	*estimated*	*once*		*Electronic, paper*	
Total CO2	*Project activity*	*Mg*	*calculated*	*5*	*All project data*	*Electronic, paper*	*Based on data collected from all plots and carbon pools*

B.8.1.2 Data for monitoring of leakage (if applicable)

>>

B.8.1.2.1. If applicable, please describe the data and information that will be collected in order to monitor leakage of the proposed small-scale A/R CDM project activity:

Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
Area under cropland within the project boundary displaced due to the project activity	survey	hectare	Measured or estimated	One time After project is established but before the first verification	30%	electronic	
Number of domesticated grazing animals within the project boundary displaced due to the project activity	survey	Number of heads	estimated	One time After project is established but before the first verification	30%	electronic	
Time-average number of grazing domesticated roaming animals per hectare within the project boundary displaced due to the project activity	survey	Number of heads	estimated	One time After project is established but before the first verification	30%	electronic	

B.8.2. Describe briefly the proposed quality control (QC) and quality assurance (QA) procedures that will be applied to monitor actual GHG removals by sinks:

>> A quality control, quality assurance (QA/QC) plan has been developed and will become a part of project documentation. This plan describes all procedures in the form of Standard Operating Procedures (SOPs) and includes:

(a) Collecting reliable field measurements;

(b) Verifying methods used to collect field data;

(c) Verifying data entry and analysis techniques;

(d) Data maintenance and archiving.

This QA/QC plan includes descriptions of how all field staff shall be trained and includes detailed SOPs for all field, laboratory, and data entry and analysis procedures. The QA/QC plan will also include SOPs to quantify the error involved with each step in the analysis including: field measurements, laboratory analysis, and data entry and analysis:

The QA/QC also includes procedures on data maintenance and storage. Due to the long-term nature of the A/R project activities, data archiving SOPs are essential. An offsite location will story copies of all data including: field measurements, laboratory measurements, and GIS products, and copies of measuring and monitoring reports. This plan will also ensure that all electronic data be upgraded as technology changes. Verification documents will be produced and filed with the project documents to show that QA/QC steps have been followed.

QA/QC for field measurements

Collecting reliable field measurements is an important step in the quality assurance plan. Those responsible for the carbon measurement work will be fully trained in all aspects of the field data collection and data analyses, and standard operating procedures will be followed rigidly to ensure accurate measurement and re-measurement. The SOPs include auditing procedures. The first type of audit, often called a 'hot check' consists of the project leader observing field crew members during data collection to ensure field measurements SOPs are followed and to correct any technique errors. The second type of audit is used to quantify measurement errors. To implement this type of check, a complete re-measurement of 10-20% of plots by people other than the original field crews will be performed at the end of the fieldwork (often called a 'blind check'). The verifying crew will be experienced in forest measurement and highly attentive to detail. After measurement a comparison will be made with the original data and discrepancies re-verified. Field data collected at this stage will be compared with the original data. Any errors found will be corrected and recorded. Any errors discovered will be expressed as a percentage of all plots that have been rechecked to provide an estimate of the measurement error.

For all the verified plots:

$$\text{Field Measurement Error (\%)} = \frac{\left(\text{Biomass before corrections - Biomass after corrections}\right)}{\text{Biomass after corrections}} \text{ x } 100 \qquad \text{(B.10)}$$

QA/QC for laboratory measurements

Standard operating procedures (SOPs) have been created and will be rigorously followed for each part of the analyses. All combustion instruments for measuring total C or C forms will be calibrated using commercially-available certified C standards. 10-20 % of samples will be reanalyzed/reweighed to produce an error estimate.

$$\text{Laboratory Error (\%)} = \frac{(\text{estimate before corrections - estimate after corrections})}{\text{estimate after corrections}} \text{ x } 100 \qquad \text{(B.12)}$$

QA/QC for data entry

To produce reliable carbon estimates the proper entry of data into the data analyses spreadsheets is required. Steps will be taken to ensure that errors are minimized. Results will be reviewed any outliers double-checked for typing errors. If there are any problems with the monitoring plot data (that cannot be resolved), the plot should not be used in the analysis.

QA/QC for data archiving

Due to the long-term length of the project activities, data storage and maintenance is very important. SOPs have been developed to ensure proper data archiving. The procedures include data archiving take several forms and copies of all data be provided to project participants. Original copies of field and laboratory data will be stored in a secure location. Copies of all data will be stored both electronically and paper in a separate remote location. Procedures also include updating storage onto new data storage technologies, both hardware and software.

B.8.3. Please describe briefly the operational and management structure(s) that the project operator will implement in order to monitor actual GHG removals by sinks by the proposed small-scale A/R CDM project activity:

>> The proposed A/R CDM project activity has been implementing by the project participants. The forestry bureaus of both Shengyang City and Kangping County are responsible for the administrating and coordinating the project participants, facilitating and supervising the implementation of the proposed small-scale A/R CDM project activities, organizing technical training and consultation, and organizing and coordinating the measuring and monitoring of the actual GHG removals by sinks and any leakage generated by the proposed small-scale A/R CDM project activities. Any activity data and monitoring and measuring data will be reported to and archived in the forestry bureaus both at county and city level.

The Forestry Bureau of Kangping County, under the guidance and coordination of the Forestry Bureau of Shengyang City, will provide instruction of afforestation and forest management, and conduct the specific supervision of the implementation of the proposed A/R CDM project activity, and collect specific activity data at routine basis.

The Forestry Bureau of Kangping County, under the guidance and coordination of the Forestry Bureau of Shengyang City, will conduct the measurement of actual GHG removal by sinks and leakage generated by the proposed small-scale A/R CDM project activity, and will be responsible for drafting monitoring report with the consultant of expert group.

The Chinese Academy of Forestry and the Keio University of Japan, under the coordination of the Forestry Bureau of Shengyang City, will provide technical consultation and training in the measuring and monitoring of the actual GHG removal by sinks and leakage generated by the proposed small-scale A/R CDM project activity, and will be responsible for helping the Forestry Bureau of Kangping County in drafting the monitoring report.

An expert team will be established for addressing any technical issues arisen, conducting checking and verification of measured and monitored data.

B.9. Date of completion of the baseline study and the name of person(s)/entity(ies) determining the baseline and the monitoring methodology:

>> **Date of completion of baseline study:** October 15, 2007

Name of persons/entity determining the monitoring methodology

Forestry Bureau of Shengyang City, P.R. China: Yingqiu Xiao, qiu9786_cn@sina.com

Forestry Bureau of Kangping County, P.R. China: Huanxin JIA, 13066520368@sohu.com

Zhangjiayao Forestry Farm: Wei DAI

Keio University, Japan: Xueping WANG, xuepingw@hotmail.com

Chinese Academy of Forestry: Xiaoquan ZHANG, xiaoquan@caf.ac.cn

SECTION C. Estimation of ex ante net anthropogenic GHG removals by sinks:

C.1. Estimated baseline net GHG removals by sinks:

>> Due to the severe desertification that the project lands suffered and are suffering, as well as occasional illegal agricultural cultivation and grazing, the lands are degraded and degrading. The carbon stocks both in the living biomass pool of woody perennials and in below-ground biomass of grasslands expect to decrease in the absence of the proposed small-scale A/R CDM project activity. Therefore, based on paragraph 6(a) and (b) of the methodology applied, the baseline carbon stocks in the living biomass pool of woody perennials and in below-ground biomass of grass are constant and equal to existing carbon stocks measured at the start of the project activity (Table C-1).

The carbon stock in living biomass pool of woody perennials and grassland was measured using randomly sampling for different baseline strata. The results are summarized in table C-1 below.

Table C-1 Carbon stock in living biomass of woody perennials and grassland

Baseline strata	Number of Sampling	Area of strata (ha)	Carbon stock per hectare (tC/ha)			Total carbon stock（tC）		
			Above-ground	Below-ground	total	Above-ground	Below-ground	total
Grassland	17	113.8	0.51	0.30	0.81	58.0	34.1	92.2
Shrubland	14	196.1	0.25	0.07	0.33	49.0	13.7	62.8
Sandy bareland	9	77.9	0.18	0.07	0.25	14.0	5.5	19.5
Total	**40**	**387.8**				**121.1**	**53.3**	**174.4**

The pre-project living trees have been counted and 10% of trees were sampled for the measurement of diameter at breast height (DBH), tree height and age. The collected information for pre-project trees is summarized in table C-2 below.

Table C-2 Pre-project living trees

Sub-compartment ID	Area (ha)	Tree species	Number of trees (trees/ha)	DBH (cm)	Height (m)	Age	Crown cover at maturity (%)
70	52.0	/	/	/	/	/	/
86	41.1	/	/	/	/	/	/
25	18.9	poplar	3.6	24.0	6.2	36	2.8
		Chinese pine	2.2	10.0	3.0	13	1.7
41	3.6	/	0.0	/	/	/	/

39,44	45.4	poplar	3.0	31.4	13.2	42	2.4
4	39.0	poplar	3.1	20.2	7.2	38	2.4
		Chinese pine	1.1	10.5	2.8	10	0.9
24,30,34	102.6	Scot pine	6.7	15.0	6.0	34	5.3
		Locust	0.3	20.7	9.3	38	0.2
7	42.1	poplar	5.2	24.8	8.3	42	4.1
14	6.3	willow	15.4	26.4	11.0	41	12.1
47	36.8	poplar	1.3	29.3	10.9	40	1.0
		Chinese pine	12.4	15.8	4.6	38	9.7
	387.8						

The mean stem volume of pre-project living poplar was estimated using formula (B.6) above. For other pre-project living tree species, following equations were used[11]:

Chinese Pine: $V = 0.0000664924\ 55 \cdot DBH^{1.8655617} \cdot H^{0.93768879}$

Scot Pine: $V = 0.00008217\ 934 \cdot DBH^{1.8318749} \cdot H^{0.88035007}$

Locust and Willow: $V = 0.00007118\ 229 \cdot DBH^{1.9414874} \cdot H^{0.81487080}$

Where

V: stem volume（m^3 $tree^{-1}$）

DBH: diameter at breast height (cm)

H: tree height (m)

The stem volume of trees was then converted into carbon stock in aboveground biomass and belowground biomass through wood density (D), biomass expansion factor (BEF), root-shoot ratio (R) and carbon fraction (CF) using equations:

$$C_{AB} = V \cdot D \cdot BEF \cdot CF$$

$$C_{BB} = C_{AB} \cdot R$$

Where

C_{AB}: carbon stock aboveground biomass, t C. $tree^{-1}$

[11]Ministry of Agriculture and Forestry. 1978. Volume table of standing trees. Beijing, China Standard Press

C_{BB}: carbon stock in belowground biomass, t C. tree[1]

V: stem volume, m^3 $tree^{-1}$

D: wood density, t $d.m.m^{-3}$

BEF: biomass expansion factor from stem bioimass to aboveground biomass, dimensionless

CF: carbon fraction, t C （t $d.m)^{-1}$, IPCC default = 0.5

R: Root-shoot ratio, dimensionless

The D, BEF and R used for different species are listed in Table C-3. BEF for spotted trees growing on open land is likely larger than forests and there is no BEF for the spotted trees. To make our estimation conservative, we assumed that BEF for single trees is 30% larger than those for forests from Table C-3. IPCC default value (0.5) is used for the carbon fraction. The carbon stock in living biomass of pre-project trees was then estimated via the number of pre-project living trees per hectare and the area (Table C-4).

Table C-3 wood density, biomass expansion factor and root-shoot ratio[11]

Tree species	Wood density (t. $d.m.m^{-3}$)	Biomass expansion factors	Root-shoot ratio
Poplar	0.378 (144, 0.009)	1.59 (108, 0.03)	0.291 (107, 0.012)
Scot pine	0.375 (22, 0.006)	2.37 (46, 0.16)	0.295 (49, 0.017)
Chinese pine	0.360 (15, 0.012)	1.62 (74, 0.04)	0.231 (89, 0.006)
Locust and Willow[12]	0.443 (189, 0.013)	1.59 (39, 0.05)	0.289 (43, 0.011)

Note: data in brackets represent the number of samples and standard errors

Table C-4 Carbon stock in living biomass of pre-project trees

Sub-compartment ID	Area (ha)	Tree species	Carbon stock per ha (tC/ha)			Total carbon stock (tC)		
			Above-ground	Below-ground	total	Above-ground	Below-ground	total
70	52.0	/	/	/	/	/	/	/
86	41.1	/	/	/	/	/	/	/
25	18.9	poplar	0.15	0.04	0.19	2.8	0.8	3.7
		Chinese pine	0.01	0.00	0.01	0.2	0.0	0.3

[11] Institute of Forest Ecology, Environment and Protection, CAF, Updated Database for China GHG Inventory in Forestry Sector.
[12] Mean value for softwood species.

41	3.6	/	/	/	/	/	/	/
39,44	46.6	poplar	0.44	0.13	0.57	20.0	5.8	25.8
4	39.0	poplar	0.11	0.03	0.14	4.2	1.2	5.4
		Chinese pine	0.01	0.00	0.01	0.2	0.1	0.3
24,30,34	102.6	Scot pine	0.22	0.06	0.28	22.6	6.7	29.2
		Locust	0.02	0.01	0.03	2.2	0.6	2.9
7	42.1	poplar	0.30	0.09	0.38	12.5	3.6	16.1
14	6.3	willow	1.74	0.51	2.25	11.0	3.2	14.1
47	36.8	poplar	0.15	0.04	0.20	5.6	1.6	7.3
		Chinese pine	0.23	0.05	0.28	8.3	1.9	10.2
	393.4					**89.6**	**25.6**	**115.2**

The carbon stock in living biomass of growing trees is expected to increase in the absence of the proposed small-scale A/R CDM project activity, due to continuous growth of existing trees. Usually poplar, willow and Locust (*Robinia pseudoacacia*) mature at the age 20, and Chinese pine and scot pine mature at the age 60 and 80[13]. Table C-1 indicates that the age of pre-project living poplar, willow and Locust at the start of the proposed small-scale A/R CDM project activity is over 36 year-old (over mature), in which case their carbon stock changes in living biomass can be assumed to be zero. Therefore, the baseline net removals by sinks were estimated as the carbon stock changes of pre-project growing Chinese pine and scot pine in the crediting period. The mean carbon stock changes were estimated by the mean age of pre-project trees (Table C-1) and the carbon stock estimated above. See table C-5 for the estimated baseline net removals by sinks.

Table C-5 Estimates of baseline net GHG removals by sinks

Years	Baseline carbon stock (tC)			Baseline net GHG removals by sinks (t CO_2 yr^{-1})		
	Abovegroun d biomass	Belowground biomass	total	Abovegroun d biomass	Belowground biomass	total
2003	210.7	78.9	289.6	3.4	0.9	4.3
2004	211.6	79.2	290.8	3.4	0.9	4.3
2005	215.0	80.1	295.1	3.4	0.9	4.3
2006	218.4	81.1	299.4	3.4	0.9	4.3
2007	221.7	82.0	303.7	3.4	0.9	4.3
2008	225.1	82.9	308.1	3.4	0.9	4.3
2009	228.5	83.9	312.4	3.4	0.9	4.3
2010	231.9	84.8	316.7	3.4	0.9	4.3

[13] China Ministry of Forestry. 1994. Forestry Inventory Manual.

2011	235.3	85.7	321.0	3.4	0.9	4.3
2012	238.6	86.7	325.3	3.4	0.9	4.3
2013	242.0	87.6	329.6	3.4	0.9	4.3
2014	245.4	88.5	333.9	3.4	0.9	4.3
2015	248.8	89.5	338.2	3.4	0.9	4.3
2016	252.1	90.4	342.6	3.4	0.9	4.3
2017	255.5	91.4	346.9	3.4	0.9	4.3
2018	258.9	92.3	351.2	3.4	0.9	4.3
2019	262.3	93.2	355.5	3.4	0.9	4.3
2020	265.6	94.2	359.8	3.4	0.9	4.3
2021	269.0	95.1	364.1	3.4	0.9	4.3
2022	272.4	96.0	368.4	3.4	0.9	4.3
Total				**67.5**	**18.7**	**86.2**

C. 2. Estimate of the actual net GHG removals by sinks:

>> The local yield table appropriate for the semi-arid sandy lands is unavailable. To estimate the growth rate of trees planted or to be planted, existing trees on similar lands have been sampled, harvested, measured, and analysed for trunk profile. Based on trunk profile analysis, growth curve has been developed as below (Equation C-2).

$$V = 0.715385 \cdot (1 - e^{(-0.104579 \cdot Age)})^{9.945217}$$

Where

V	Standing volume of poplar planted or to be planted, $m^3.tree^{-1}$
Age	Age of trees, year

Growth data (standing volume per tree) are converted into aboveground biomass via wood density (WD) and Biomass Expansion Factors (BEF) (Table B-1), assuming that the growth data can apply to all strata and survival rate is 85%, by using equation (14) of the methodology applied.

$$T_{(t),tree} = SV_{(t)} \cdot BEF \cdot WD$$

$$SV_{(t)} = V_t \cdot 708$$

where:

$T_{(t),tree}$	estimate of above-ground biomass of trees at time *t* achieved by the project activity (t $dm.ha^{-1}$)
$SV_{(t)}$	stem volume of trees at time *t*, cubic meter ($m^3.ha^{-1}$)
WD	basic wood density (t d.m. m^{-3})
BEF	biomass expansion factor from stem to aboveground biomass (dimensionless)
V_t	stem volume of trees at time *t*, ($m^3.tree^{-1}$)
708	Number of trees survived (assuming 85% of survival rate)

The carbon stocks in above- and below-ground biomass of trees are then calculated using equation (13) and equation (15) of the approved methodology applied.

$$N_{A(t),tree} = T_{(t),tree} \cdot 0.5$$

$$N_{B(t),tree} = T_{(t),tree} \cdot R \cdot 0.5$$

where:

$N_{A(t),tree}$	= carbon stocks in above-ground biomass of planted trees at time t under the project scenario (t C/ha)
$N_{B(t),tree}$	= carbon stocks in above-ground biomass of planted trees at time t under the project scenario (t C/ha)
0.5	=carbon fraction of dry matter (t C/t dm)
R	=root to shoot ratio (dimensionless), from table B-1

The stocks of carbon for the project scenario at the starting date of the project activity (t=0) are same as the baseline scenario at t=0. For all other years, carbon stock for the project scenario at time t is th sum of baseline carbon stock and the carbon stock of trees planted or to be planted by the proposed small-scale A/R CDM project activity.

The removal component of actual net GHG removals by sinks can be calculated by:

$$\Delta C_{PROJ,t} = (N_t - N_{t-1}) \cdot (44/12) / \Delta t$$

Where:

$\Delta C_{PROJ,t}$	removal component of actual net GHG removals by sinks per annum (t CO2-e / year)
$N_{(t)}$	Total carbon stocks in biomass at time *t* under the project scenario (t C)
Δt	time increment = 1 (year)

Since there will be no fertilizer application, GHG emission $GHG_{PROJ,t} = 0$, therefore,

$$\Delta C_{ACTUAL,t} = \Delta C_{PROJ,t} \quad \text{(C.6)}$$

Where:

$\Delta C_{ACTUAL,t}$	ex-ante actual net greenhouse gas removals by sinks in year t (t CO2-e / year)
$\Delta C_{PROJ,t}$	project GHG removals by sinks (t CO2-e / year)
$GHG_{PROJ,t}$	project emissions (t CO2-e / year)

The estimated actual net GHG removals by sinks over the 20-year-crediting period are listed in Table C-6 below.

Table C-6 Estimate of actual net GHG removals by sinks [14]

Year	Carbon stock (t C)			Actual net GHG removals by sinks ($tCO_2\ yr^{-1}$)		
	Aboveground biomass	Belowground biomass	Total	Aboveground biomass	Belowground biomass	Total
2003	211	79	290	-773	-289	-1,062
2004	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	0	0	0	0	0	0
2007	0	0	0	1	0	1
2008	1	0	2	4	1	5
2009	5	2	7	14	4	18
2010	16	5	20	39	11	50
2011	39	11	50	86	25	111

[14] Notes: minus sign indicates the source while plus indicates the sink.

2012	84	24	108	164	48	211
2013	160	47	207	280	82	362
2014	281	82	363	443	129	571
2015	460	134	594	658	191	849
2016	715	208	923	935	272	1,207
2017	1,065	310	1,375	1,283	373	1,657
2018	1,532	446	1,978	1,712	498	2,210
2019	2,139	622	2,761	2,224	647	2,871
2020	2,906	846	3,752	2,815	819	3,634
2021	3,853	1,121	4,974	3,471	1,010	4,482
2022	4,991	1,452	6,443	4,173	1,214	5,387
total				17,528	5,036	22,564

C. 3. Estimated leakage:

>> s described in Section B above, the leakage due to displacement of activities is unlikely to occur, therefore,

$$L_t = 0$$

Where

L_t leakage attributable to the project activity at time t (t CO_2-e / year)

C. 4. The sum of C. 2. minus C.1 minus C.3 representing the net anthropogenic GHG removals by sinks of the proposed small-scale A/R CDM project activity:

>> The sum of C.2 minus C.3 minus C4 indicates that the net anthropogenic GHG removals by sinks as a result of the proposed small-scale A/R CDM project activity is anticipated to be around 22,751 tonnes of CO_2 equivalent during the crediting period (between 01 January 2003and 31 Dec 2022) per the Table C-7.

Table C-7 Estimates of net anthropogenic GHG removals by sinks

Year	Annual net anthropogenic GHG removals by sinks (t CO_2-e yr^{-1})	Cumulative net anthropogenic GHG removals by sinks (t CO_2-e)
2003	-1,066	-1,066
2004	-4	-1,071
2005	-4	-1,075
2006	-4	-1,079
2007	-3	-1,083
2008	1	-1,082
2009	14	-1,068
2010	46	-1,022
2011	106	-916
2012	207	-709
2013	358	-351

2014	567	216
2015	845	1,061
2016	1,202	2,263
2017	1,653	3,916
2018	2,206	6,122
2019	2,867	8,988
2020	3,629	12,618
2021	4,477	17,095
2022	5,382	22,477

C. 5. Table providing values obtained when applying formulae above:

>> See Table C-8.

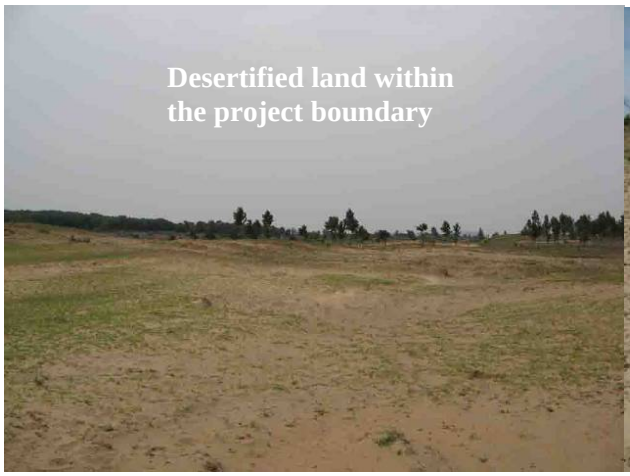
Table C-8

Years	Estimation of baseline net GHG removals by sinks (tonnes of CO_2 e yr^{-1})	Estimation of actual net GHG removals by sinks (tonnes of CO2 e yr^{-1})	Estimation of leakage (tonnes of CO2 e yr^{-1})	Estimation of net anthropogenic GHG removals by sinks (tonnes of CO2 e yr^{-1})
A	B	C	D	E=C+D-B
2003	4.3	-1,062	0	-1,066
2004	4.3	0	0	-4
2005	4.3	0	0	-4
2006	4.3	0	0	-4
2007	4.3	1	0	-3
2008	4.3	5	0	1
2009	4.3	18	0	14
2010	4.3	50	0	46
2011	4.3	111	0	106
2012	4.3	211	0	207
2013	4.3	362	0	358
2014	4.3	571	0	567
2015	4.3	849	0	845
2016	4.3	1,207	0	1,202
2017	4.3	1,657	0	1,653
2018	4.3	2,210	0	2,206
2019	4.3	2,871	0	2,867
2020	4.3	3,634	0	3,629
2021	4.3	4,482	0	4,477
2022	4.3	5,387	0	5,382
Total (tonnes of CO_2 e)	86.2	22,564	0	22,477

SECTION D. Environmental impacts of the proposed small-scale A/R CDM project activity:

D. 1. Provide analysis of the environmental impacts, including transboundary impacts (if any):

>> The proposed small scale A/R CDM project activity is located in the southern fringe of the Kerqin Desert. The project area has been suffering from wind erosion and land desertification, and is one of areas most severely threatened by desertification and sand storm. The desertified lands is up to 160,000 hectare, amount to 73.6% of the total area in the County. Moreover, the Kerqin Desert is extending 100 meter southward annually and the desertified land area in Kangping County is increasing 3.3 km^2 annually. If currently situation remains as it has been, the lands will desertify further and the wind erosion will become more and more severe. Therefore, the forest restoration will alleviate wind erosion and desertification in this area, as a result improve local production and living environmental conditions.



D. 2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken an environmental impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

>> No significant negative impacts have been identified.

D. 3. Description of planned monitoring and remedial measures to address significant impacts referred to in section D.2. above::

>> Not applicable.

SECTION E. Socio-economic impacts of the proposed small-scale A/R CDM project activity:

E.1. Provide analysis of the socio-economic impacts, including transboundary impacts (if any):

>> Due to unfavourable arid climate, poor soil conditions, wind erosion, desertification and lack of additional income, the local people live far below the national poverty level. Income per household was only 2000-3000 Yuan RMB (US$ 266~400) in 2006 for forestry farmers. The income is mainly from agricultural cultivation, forest by-product such as mushroom.
To maximize the socio-economic benefit, the afforestation design was prepared with a participatory approach. PRA methods were adopted in interviewing and consulting with forestry farms and households in the project areas to understand the local forestry farmers' preferences, wishes and concerns, so that the proposed small-scale A/R CDM project activity would better respond to their desires for livelihood development (see Section F below). It is expected that 245 forestry farmers from the forestry farms and more villagers surrounding the project area will benefit from the proposed project. The main socio-economic benefits of the project include:

(1) Income generation: Forestry farmers and farmers surrounding the project area will obtain additional incomes from wood and non-wood product, intercrop, labors and CERs.

(2) Creating employment: The proposed small-scale A/R CDM project activity will create about 100,000 person-days of temporary employment opportunities from planting, weeding, forest management and harvesting. It will also create 5 long-term job positions during the crediting period. Most employment opportunities will be taken by the forestry farmers involved in the proposed small-scale A/R CDM project activity and beyond (whose lands do not fall within the project boundary). The employment opportunities will be available equally to local ethnic minority group.

E. 2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken a socioeconomic impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

>>No significant negative socio-economic impacts has been identified.

E. 3. Description of planned monitoring and remedial measures to address significant impacts referred to in section E.2. above:

>>N/A

SECTION F. Stakeholders' comments:

F. 1. Brief description of how comments by local stakeholders have been invited and compiled:

>> Comments by stakeholders have been invited using PRA methodology, specifically the PRA include following processes:

(1) **Distribution of leaflet.** A project leaflet has been prepared with the brief introduction of the project objective, main activities, benefits and potential risk, as well as the modalities and procedures of the CDM A/R project. The leaflet was distributed to the proposed project communities before the PRA process, and was explained during the PRA process.

(2) **Seminar of representatives**. To get comprehensive information of the historic and current situation and existing problems in local communities, as well as to understand the need and desire of the forestry farmers, representative meetings of forestry farmers were held 3 times. Each representative meeting had at least 15 representatives including 4-5 women representatives. Main topic include, inter alia:

- Introduction of the project objective, main activities, benefits and potential risk, as well as the modalities and procedures of the CDM A/R project activity;
- Introduction of the objective, task, methods and main activities of the investigation, and how the local communities to involve in the investigation;
- Question and discussion;

(3) **Questionnaire**. Questionnaire forms were developed and distributed among different stakeholders, including forestry farmer households, forestry farms, and forestry bureau. The questionnaire forms were collected and analyzed to understand the local socio-economic profiles, land use, land tenure, income and sources, land management ways, awareness, technical know-how, favorable tree species, technical and financial barriers, need and desire of forestry farmers in the ways to participating in the proposed small-scale A/R CDM project activity from relevant stakeholders. 48 questionaire forms have been received.

F.2. Summary of the comments received:

>> Comments from forestry farmers, forestry farm, local forestry department and government etc. are summarized as follow:

1. Primary stakeholders

The forestry farmers and forestry farm express their strong interests to participate in the proposed small-scale A/R CDM project activity because they thought that through participating in the project activity they can obtain the following benefits:

- ✓ Income increase from selling wood and non-wood products, intercrop, CERs and from labor input;
- ✓ Greening their desertified lands that can improve local environment, shelter land and mitigate desertification.

PRA survey indicates that all forestry farmer households and forestry farms willing to participate the proposed small-scale A/R CDM project activity. The forestry farmers indicated that without the proposed A/R CDM project activity it is impossible for them to plant trees on the project area due to huge pre-investment and low economic return in terms of the desertified lands.

During the PRA process, the scoring assessment on tree species also indicates that the forestry farmers prefer to plant poplar as they think it is a good practice in terms of the growth rate and climate and soil conditions.

2. Secondary stakeholders

(1) Local forestry departments: Forestry Bureaus of Kangping County and Shengyang City view that the proposed small-scale A/R CDM project activity will increase forest resources, mitigate desertification, improve the local environment and increase income of forestry farmers/farms, as well as demonstrate the modalities and procedures of the small-scale A/R CDM project activity. They would provide technical training and consultation to farmers/farms, and supervise the implementation of the proposed A/R CDM project activity.

(2) Local Governments: County governments of Kangping County consider that the proposed small-scale A/R CDM project activity can improve local economy and alleviate local poverty, and at the same time benefit to globally climate change mitigation and desertification combating. Therefore, the proposed small-scale A/R CDM project activity would have great impacts as if technical best practices developed by the proposed small-scale A/R CDM project activity are extended to neighbouring areas or local communities that do not involve in the project.

F.3. Report on how due account was taken of any comments received:

>> The comments received from the PRA survey were fully taken into account as follows:

- Participation is on a voluntarily basis.
- Preferences of local farmers/farms and government were taken into account in the selection of tree species;

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROPOSED SMALL-SCALE A/R CDM PROJECT ACTIVITY

Organization:	Zhangjiayao Forest Management Company Ltd
Street/P.O.Box:	Kangping Zhangjiayao Forestry Farm, Kangping County
Building:	
City:	Shenyang City
State/Region:	Liaoning Province
Postfix/ZIP:	110500
Country:	P.R. China
Telephone:	024 87260015
FAX:	
E-Mail:	
URL:	
Represented by:	LUO Wenjie
Title:	Director
Salutation:	
Last Name:	Luo
Middle Name:	
First Name:	Wenjie
Department:	
Mobile:	13109867948
Direct FAX:	024 86170662
Direct tel:	024 86172895
Personal E-Mail:	

PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES
(CDM- SSC-AR-PDD) - Version 02

Organization:	Keio University
Street/P.O.Box:	Mita
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FAX:	+81-(0)3-5427-1640
E-Mail:	hayami@sanken.keio.ac.jp
URL:	http://www.keio.ac.jp/
Represented by:	Yuichiro Anzai
Title:	President
Salutation:	
Last Name:	Anzai
Middle Name:	
First Name:	Yuichiro
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no available public funding that will result in a diversion of official development assistance and financial obligations of any Parties under UNFCCC.

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Annex 3

DECLARATION ON LOW-INCOME COMMUNITIES

Please provide a written declaration that the proposed small-scale afforestation or reforestation project activity under the CDM is developed or implemented by low-income communities and individuals as determined by the host Party.

Lands planted or to be planted in the proposed A/R CDM project activity are located in the Zhangjiayao Forestry Farm. The farm was established in 1956 with a purpose of sand fixing and windbreak. The main income source was governmental subsidy and sale of limited timber. However the subsidy from government has gradually stopped and license for forest logging has been strictly controlled since 1985, resulting in a severe economic difficulty to the farm.

There are 46 staff and workers in the farm in addition to 18 retired. Kangping County in which the farm is located is a provincial level of poverty county. The annual income of the farm's staff and workers is as low as 2,500 Yuan RMB, which is even lower than mean annual income of farmers in the Kangping County. This income is also much lower than the international poverty line (2 US$ per day per capita). Therefore, the proposed small-scale afforestation or reforestation project activity under the CDM is developed or implemented by low-income communities and individuals as determined by the host Party.

Annex 4
PARCELS AND CORNER COORDINATES OF THE PROJECT LANDS

No.	Longitude			latitude				No.	Longitude			latitude		
1	°	′	″	°	′	″		16						
	122	45	39.9	42	40	36.4			122	47	13.1	42	41	16.4
	122	45	57.2	42	40	44.3			122	47	20.1	42	41	29.3
	122	45	45.1	42	40	30.4			122	47	19.4	42	41	27.2
	122	45	30.7	42	40	33.0			122	47	16.0	42	41	22.9
	122	45	23.5	42	40	34.1			122	47	20.5	42	41	23.6
	122	45	24.7	42	40	37.9			122	47	20.3	42	41	22.0
	122	45	33.4	42	40	36.8			122	47	25.2	42	41	20.0
	122	45	33.4	42	40	41.6			122	47	28.2	42	41	22.6
	122	45	47.1	42	40	39.7			122	47	28.6	42	41	22.3
	122	45	57.2	42	40	44.3			122	47	28.4	42	41	20.7
2									122	47	25.2	42	41	17.4
	122	46	5.4	42	40	31.4			122	47	29.2	42	41	14.0
	122	46	17.1	42	40	41.7			122	47	28.6	42	41	10.5
	122	46	16.7	42	40	31.5			122	47	27.0	42	41	8.8
	122	46	18.3	42	40	31.8			122	47	27.8	42	41	5.5
	122	46	22.0	42	40	19.1			122	47	23.9	42	41	6.2
	122	46	20.7	42	40	17.6			122	47	17.4	42	41	3.1
	122	46	17.1	42	40	17.4			122	47	16.2	42	41	3.9
	122	45	58.7	42	40	25.5			122	47	18.6	42	41	6.1
	122	45	57.8	42	40	24.1			122	47	19.6	42	41	8.3
	122	45	43.8	42	40	29.0			122	47	16.7	42	41	8.2
	122	45	55.7	42	40	41.3			122	47	15.4	42	41	6.0
	122	45	57.5	42	40	40.6			122	47	13.6	42	41	6.6
	122	46	0.0	42	40	44.1			122	47	13.2	42	41	5.7
	122	46	17.1	42	40	41.7			122	47	11.3	42	41	6.2
3									122	47	12.1	42	41	7.4
	122	46	25.9	42	41	4.4			122	47	10.4	42	41	7.7
	122	46	25.1	42	41	0.8			122	47	9.7	42	41	6.6
	122	46	20.2	42	40	54.4			122	47	7.7	42	41	9.0
	122	46	18.1	42	40	55.8			122	47	6.0	42	41	6.7
	122	46	21.9	42	41	1.4			122	47	10.1	42	41	4.7
	122	46	21.3	42	41	3.0			122	47	9.2	42	41	3.0
	122	46	23.8	42	41	5.9			122	47	9.8	42	41	2.7
	122	46	21.4	42	41	7.8			122	47	10.1	42	41	0.3
	122	46	29.9	42	41	11.0			122	47	9.0	42	40	57.8
	122	46	34.4	42	41	7.9			122	47	5.2	42	40	58.7
	122	46	25.1	42	41	0.8			122	47	3.2	42	41	0.6

4									122	47	3.2	42	41	3.6
	122	45	0.3	42	40	45.1			122	47	3.7	42	41	9.0
	122	45	13.3	42	40	47.5			122	47	2.2	42	41	11.6
	122	45	9.6	42	40	36.0			122	47	3.7	42	41	13.6
	122	44	56.0	42	40	37.7			122	46	59.1	42	41	17.1
	122	44	47.2	42	40	38.0			122	47	3.3	42	41	22.4
	122	44	52.8	42	40	54.9			122	46	58.5	42	41	25.6
	122	44	57.0	42	40	56.2			122	46	59.8	42	41	28.9
	122	45	12.9	42	40	48.3			122	47	2.0	42	41	29.3
	122	45	13.3	42	40	47.5			122	47	5.1	42	41	29.1
5									122	47	6.6	42	41	31.9
	122	46	19.2	42	40	51.4			122	47	9.0	42	41	31.4
	122	46	22.8	42	40	53.4			122	47	8.4	42	41	29.5
	122	46	19.7	42	40	47.1			122	47	10.9	42	41	29.6
	122	46	17.0	42	40	48.2			122	47	13.2	42	41	27.9
	122	46	16.1	42	40	50.2			122	47	14.4	42	41	31.9
	122	46	18.1	42	40	55.8			122	47	19.7	42	41	32.6
	122	46	20.2	42	40	54.4			122	47	20.1	42	41	29.3
	122	46	22.8	42	40	53.4	17							
6									122	48	40.2	42	39	57.3
	122	47	21.1	42	39	0.1			122	48	42.8	42	39	54.6
	122	47	22.7	42	39	5.1			122	48	36.1	42	39	48.3
	122	47	24.5	42	39	3.0			122	48	33.2	42	39	49.6
	122	47	25.9	42	39	3.5			122	48	33.4	42	39	51.3
	122	47	27.0	42	39	2.2			122	48	45.0	42	40	7.2
	122	47	22.5	42	38	56.6			122	48	43.0	42	40	8.7
	122	47	20.2	42	38	57.8			122	48	43.6	42	40	10.7
	122	47	19.1	42	38	57.8			122	48	46.1	42	40	8.6
	122	47	16.3	42	38	56.3			122	48	45.2	42	40	3.0
	122	47	14.7	42	38	54.6			122	48	44.2	42	40	0.6
	122	47	13.3	42	38	55.0			122	48	43.7	42	39	57.8
	122	47	18.1	42	39	0.4			122	48	42.8	42	39	54.6
	122	47	21.2	42	39	2.3	18							
	122	47	20.2	42	39	3.9			122	46	32.0	42	41	2.7
	122	47	22.7	42	39	5.1			122	46	35.8	42	40	57.4
7									122	46	32.7	42	40	53.5
	122	48	40.8	42	39	5.0			122	46	27.1	42	40	54.3
	122	48	48.6	42	39	3.5			122	46	24.1	42	40	56.1
	122	48	46.9	42	38	59.4			122	46	33.2	42	41	12.3
	122	48	28.3	42	39	11.2			122	46	37.6	42	41	14.2
	122	48	35.1	42	39	8.8			122	46	39.3	42	41	11.7
	122	48	39.0	42	39	8.6			122	46	35.7	42	41	5.5

	122	48	41.8	42	39	5.4
	122	48	48.6	42	39	3.5
8						
	122	45	53.3	42	40	45.5
	122	45	58.6	42	40	45.5
	122	45	57.5	42	40	44.2
	122	45	49.1	42	40	45.2
	122	45	47.8	42	40	42.8
	122	45	49.5	42	40	47.0
	122	45	58.6	42	40	45.5
10						
	122	48	27.8	42	39	5.9
	122	48	33.9	42	39	7.8
	122	48	31.3	42	39	1.2
	122	48	28.4	42	39	3.1
	122	48	22.1	42	39	4.1
	122	48	20.2	42	39	5.3
	122	48	25.9	42	39	9.6
	122	48	28.0	42	39	9.6
	122	48	33.9	42	39	7.8
11						
	122	46	22.2	42	41	36.5
	122	46	26.4	42	41	37.2
	122	46	24.7	42	41	34.5
	122	46	29.9	42	41	31.7
	122	46	25.9	42	41	32.3
	122	46	22.3	42	41	32.6
	122	46	22.7	42	41	35.6
	122	46	19.5	42	41	33.9
	122	46	19.2	42	41	36.6
	122	46	14.8	42	41	37.1
	122	46	14.4	42	41	38.5
	122	46	15.0	42	41	41.8
	122	46	16.8	42	41	44.4
	122	46	20.4	42	41	43.9
	122	46	21.7	42	41	43.3
	122	46	19.3	42	41	38.1
	122	46	26.4	42	41	37.2
12						
	122	47	27.5	42	39	18.9
	122	47	52.2	42	39	19.3
	122	47	51.4	42	39	19.0

	122	46	34.0	42	41	0.6
	122	46	35.8	42	40	57.4
19						
	122	48	33.3	42	38	57.7
	122	48	30.4	42	38	42.1
	122	48	25.5	42	38	41.2
	122	48	23.8	42	38	42.3
	122	48	26.9	42	38	49.4
	122	48	22.1	42	38	54.3
	122	48	22.3	42	38	59.1
	122	48	23.5	42	39	2.6
	122	48	20.0	42	39	4.7
	122	48	18.6	42	39	6.4
	122	48	21.6	42	39	8.5
	122	48	28.3	42	39	11.2
	122	48	35.1	42	39	8.8
	122	48	39.0	42	39	8.6
	122	48	41.8	42	39	5.4
	122	48	48.6	42	39	3.5
	122	48	46.9	42	38	59.4
	122	48	45.4	42	38	51.8
	122	48	42.0	42	38	48.5
	122	48	40.6	42	38	48.1
	122	48	34.9	42	38	45.8
	122	48	31.1	42	38	45.5
	122	48	30.4	42	38	42.1
20						
	122	47	8.2	42	40	41.3
	122	47	21.0	42	40	53.6
	122	47	20.5	42	40	45.0
	122	47	17.4	42	40	40.2
	122	47	7.4	42	40	34.0
	122	47	13.6	42	40	30.3
	122	47	12.5	42	40	27.9
	122	47	8.3	42	40	28.0
	122	46	55.4	42	40	37.2
	122	46	58.1	42	40	42.6
	122	47	3.1	42	40	51.6
	122	47	4.4	42	40	51.2
	122	47	9.7	42	40	49.3
	122	47	13.4	42	40	48.2
	122	47	21.0	42	40	53.6

	122	47	50.0	42	39	19.2		21							
	122	47	48.9	42	39	18.5			122	46	56.6	42	40	27.1	
	122	47	47.7	42	39	18.8			122	47	8.3	42	40	28.0	
	122	47	45.2	42	39	17.1			122	46	58.3	42	40	22.3	
	122	47	45.6	42	39	16.7			122	46	57.5	42	40	22.5	
	122	47	43.1	42	39	14.8			122	46	55.4	42	40	21.5	
	122	47	41.2	42	39	16.1			122	46	51.2	42	40	18.3	
	122	47	35.4	42	39	13.6			122	46	46.6	42	40	20.5	
	122	47	34.5	42	39	12.6			122	46	46.0	42	40	22.3	
	122	47	33.8	42	39	11.1			122	46	47.5	42	40	23.7	
	122	47	31.6	42	39	12.3			122	46	51.1	42	40	26.4	
	122	47	32.4	42	39	13.7			122	46	53.8	42	40	31.1	
	122	47	29.6	42	39	14.4			122	46	53.8	42	40	34.5	
	122	47	26.7	42	39	12.0			122	46	55.4	42	40	37.2	
	122	47	27.3	42	39	9.1			122	47	8.3	42	40	28.0	
	122	47	25.4	42	39	7.1		22							
	122	47	20.4	42	39	4.3			122	46	9.9	42	41	28.1	
	122	47	19.0	42	39	1.0			122	46	10.4	42	41	48.4	
	122	47	15.8	42	39	0.8			122	46	16.0	42	41	45.3	
	122	47	14.2	42	39	3.7			122	46	21.5	42	41	45.7	
	122	47	14.9	42	39	4.5			122	46	21.5	42	41	42.4	
	122	47	12.2	42	39	21.5			122	46	18.5	42	41	38.6	
	122	47	15.9	42	39	24.4			122	46	25.2	42	41	37.2	
	122	47	13.7	42	39	30.7			122	46	26.7	42	41	34.1	
	122	47	16.1	42	39	32.5			122	46	29.5	42	41	39.3	
	122	47	54.2	42	39	22.3			122	46	29.7	42	41	31.1	
	122	47	52.2	42	39	19.3			122	46	18.2	42	41	31.6	
13									122	46	20.4	42	41	30.2	
	122	45	21.8	42	40	41.0			122	46	22.3	42	41	29.8	
	122	45	30.4	42	40	45.3			122	46	18.6	42	41	26.2	
	122	45	26.6	42	40	34.9			122	46	0.8	42	41	14.9	
	122	45	13.3	42	40	37.6			122	45	57.7	42	41	11.6	
	122	45	16.1	42	40	46.3			122	45	52.2	42	41	5.5	
	122	45	30.4	42	40	45.3			122	45	50.4	42	41	5.2	
14									122	45	48.9	42	41	10.7	
	122	45	50.7	42	40	45.2			122	45	53.6	42	41	17.7	
	122	45	58.4	42	40	46.1			122	45	58.9	42	41	21.6	
	122	45	53.8	42	40	40.5			122	46	4.8	42	41	27.6	
	122	45	51.6	42	40	43.5			122	46	6.5	42	41	31.1	
	122	45	41.2	42	40	45.6			122	46	10.0	42	41	34.3	
	122	45	41.3	42	40	46.4			122	46	11.3	42	41	37.4	
	122	45	48.4	42	40	47.8			122	46	10.7	42	41	42.7	

	122	45	58.4	42	40	46.1
15						
	122	47	42.5	42	39	39.2
	122	47	46.9	42	39	56.2
	122	47	56.9	42	39	52.5
	122	47	57.0	42	39	50.4
	122	47	54.7	42	39	46.0
	122	47	55.6	42	39	43.5
	122	47	54.3	42	39	43.3
	122	47	54.5	42	39	41.0
	122	47	54.8	42	39	39.3
	122	47	56.1	42	39	38.1
	122	47	55.8	42	39	37.5
	122	47	56.1	42	39	36.7
	122	47	57.2	42	39	36.2
	122	47	59.5	42	39	35.8
	122	47	57.8	42	39	34.9
	122	47	56.6	42	39	32.7
	122	47	59.0	42	39	30.6
	122	47	55.7	42	39	24.3
	122	47	54.2	42	39	22.3
	122	47	16.1	42	39	32.5
	122	47	27.6	42	39	38.7
	122	47	29.5	42	39	39.4
	122	47	31.7	42	39	41.2
	122	47	31.4	42	39	41.7
	122	47	31.9	42	39	43.9
	122	47	31.3	42	39	44.3
	122	47	32.5	42	39	45.5
	122	47	33.3	42	39	47.9
	122	47	32.4	42	39	49.0
	122	47	37.2	42	39	54.4
	122	47	35.9	42	39	54.4
	122	47	39.4	42	39	57.9
	122	47	43.2	42	39	58.5
	122	47	46.9	42	39	56.2
	122	46	9.0	42	41	46.3
	122	46	10.4	42	41	48.4

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