

HENAN NANZHAO AFFORESTATION PROJECT



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1 PROJECT DETAILS

1.1 SUMMARY DESCRIPTION OF THE PROJECT

The Henan Nanzhao Afforestation Project (hereafter “the project”) is located in Nanzhao County, Nanyang City, Henan Province, China. The project is to establish forest on the barren hills and wasteland to generate GHG emission reductions and contribute to local sustainable development. The project is implemented by 27,380 ha of forest is to be established by direct planting on barren hills in Nanzhao county, Nanyang City, Henan Province.

The project activity aims to:

- Sequester greenhouse gas and mitigate climate change;
- Enhance biodiversity conservation by increasing the connectivity of forests;
- Improve soil and water conservation and contribute to sustainable development;
- Generate income and job opportunities for local communities.

There is no natural renewal and reforestation and all sites were barren hills and wastelands at least 10 years prior to the project,, the project will not convert native ecosystems to create GHG credits. The implementation of the project activity converses the trees to protected forest to reduce the GHG emissions for about 30,922,399 tCO₂^e in 60 years, the average annual emission reduction is 515,373 tCO₂^e and Verified Carbon Units with buffer deduction is about 24,119,471 tCO₂^e in 60 years, and average annual VCUs with buffer deduction is 401,991 tCO₂^e.

1.2 SECTORAL SCOPE AND PROJECT TYPE

The activity implemented by the project is the establishment of forests on land that were barren hills and wasteland. Therefore corresponds to VCS scope 14 “Agriculture, Forestry and Other Land Use” as an Afforestation, reforestation and Revegetation (ARR).

1.3 PROJECT PROPONENT

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1.4 OTHER ENTITIES INVOLVED IN THE PROJECT

N/A

1.5 PROJECT START DATE

The project start date is 01/09/2014, when the activities that lead to the generation of GHG emission removals were first implemented.

1.6 PROJECT CREDITING PERIOD

The project crediting period is from 01/09/2014 to 31/08/2074 with a lifetime of 60 years.

1.7 PROJECT SCALE AND ESTIMATED GHG EMISSION REDUCTIONS OR REMOVALS

Project Scale	
Project	
Large project	X

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated GHG emission reductions or removals (tCO ₂ e)
2014.9.1-2015.8.31	0	9,733	0	9,733
2015.9.1-2016.8.31	0	23,081	0	23,081
2016.9.1-2017.8.31	0	37,226	0	37,226
2017.9.1-2018.8.31	0	46,676	0	46,676
2018.9.1-2019.8.31	0	62,385	0	62,385
2019.9.1-2020.8.31	0	83,868	0	83,868
2020.9.1-2021.8.31	0	98,217	0	98,217
2021.9.1-2022.8.31	0	113,831	0	113,831
2022.9.1-2023.8.31	0	130,972	0	130,972
2023.9.1-2024.8.31	0	148,648	0	148,648
2024.9.1-2025.8.31	0	166,934	0	166,934

2025.9.1- 2026.8.31	0	185,853	0	185,853
2026.9.1- 2027.8.31	0	205,389	0	205,389
2027.9.1- 2028.8.31	0	225,500	0	225,500
2028.9.1- 2029.8.31	0	246,126	0	246,126
2029.9.1- 2030.8.31	0	267,191	0	267,191
2030.9.1- 2031.8.31	0	288,612	0	288,612
2031.9.1- 2032.8.31	0	310,302	0	310,302
2032.9.1- 2033.8.31	0	332,170	0	332,170
2033.9.1- 2034.8.31	0	354,127	0	354,127
2034.9.1- 2035.8.31	0	376,087	0	376,087
2035.9.1- 2036.8.31	0	397,967	0	397,967
2036.9.1- 2037.8.31	0	419,690	0	419,690
2037.9.1- 2038.8.31	0	441,183	0	441,183
2038.9.1- 2039.8.31	0	462,381	0	462,381
2039.9.1- 2040.8.31	0	483,224	0	483,224
2040.9.1- 2041.8.31	0	503,660	0	503,660
2041.9.1- 2042.8.31	0	523,642	0	523,642
2042.9.1- 2043.8.31	0	543,132	0	543,132
2043.1.1- 2044.8.31	0	562,094	0	562,094
2044.9.1- 2045.8.31	0	580,502	0	580,502
2045.9.1- 2046.8.31	0	598,334	0	598,334
2046.9.1- 2047.8.31	0	615,572	0	615,572

2047.9.1- 2048.8.31	0	632,206	0	632,206
2048.9.1- 2049.8.31	0	648,227	0	648,227
2049.9.1- 2050.8.31	0	663,632	0	663,632
2050.9.1- 2051.8.31	0	678,422	0	678,422
2051.9.1- 2052.8.31	0	692,601	0	692,601
2052.9.1- 2053.8.31	0	706,175	0	706,175
2053.1.1- 2054.8.31	0	719,153	0	719,153
2054.9.1- 2055.8.31	0	731,548	0	731,548
2055.9.1- 2056.8.31	0	743,373	0	743,373
2056.9.1- 2057.8.31	0	754,643	0	754,643
2057.9.1- 2058.8.31	0	765,376	0	765,376
2058.9.1- 2059.8.31	0	775,588	0	775,588
2059.9.1- 2060.8.31	0	785,300	0	785,300
2060.9.1- 2061.8.31	0	794,530	0	794,530
2061.9.1- 2062.8.31	0	803,300	0	803,300
2062.9.1- 2063.8.31	0	811,629	0	811,629
2063.1.1- 2064.8.31	0	819,538	0	819,538
2064.9.1- 2065.8.31	0	827,049	0	827,049
2065.9.1- 2066.8.31	0	834,182	0	834,182
2066.9.1- 2067.8.31	0	840,958	0	840,958
2067.9.1- 2068.8.31	0	847,398	0	847,398
2068.9.1- 2069.8.31	0	853,521	0	853,521

2069.9.1-2070.8.31	0	859,348	0	859,348
2070.9.1-2071.8.31	0	864,897	0	864,897
2071.9.1-2072.8.31	0	870,189	0	870,189
2072.9.1-2073.8.31	0	875,239	0	875,239
2073.1.1-2074.8.31	0	880,068	0	880,068
Total		30,922,399 tCO ₂ ^e		
Total number of crediting years		60		
Average annual ERs		515,373 tCO ₂ ^e		

1.8 DESCRIPTION OF THE PROJECT ACTIVITY

All sites were barren hills and wastelands at least 10 years prior to the project, the project will not convert native ecosystems to create GHG credits. The project is to establish forest on the barren hills and wasteland to generate GHG emission reductions and contribute to local sustainable development. The project is implemented by about 27,380ha of forest is to be established by direct planting on barren hills in Nanzhao county, Nanyang City, Henan Province. The project involves 15 towns of Nanzhao Country, which are Chengguan Town, Chengjiao Town, Liushan Town, Xiaodian Town, Yunyang Town, Huanghou Town, Taishanmiao Town, Shimen Town, Sikeshu Town, Nanhedian Town, Baitugang Town, Banshanping Town, Qiaoduan Town, Mashiping Town, Cuizhuang Town. Aiming to contribute to the local sustainable development, especially to mitigating the water and soil erosion, 27,380 ha of forest would be established by direct planting on the barren hills and wasteland. in these 15 towns. Considering the goal of the project activity, the native species Magnolia and Oak tree are chosen as the target species. Seedling planting is chosen as the forestation method. Seedling must be robust with developed root system, has no mechanical damage and no diseases, and has complete crown.

The forestation activities intend to contribute to climate change mitigation through sequestration of atmospheric CO₂ during biomass growth. The local communities will benefit from the project in enhancing job opportunities, improved environment and landscape restoration.

1.9 PROJECT LOCATION

The project is located in Nanzhao County, Nanyang City, Henan Province, China. The geographical coordinates of the project is between 111°55' and 112°51' east longitude and between 33°12' and 33°43' north latitude.

The location of the project activity in Henan Province is illustrated in Figure 1-1.

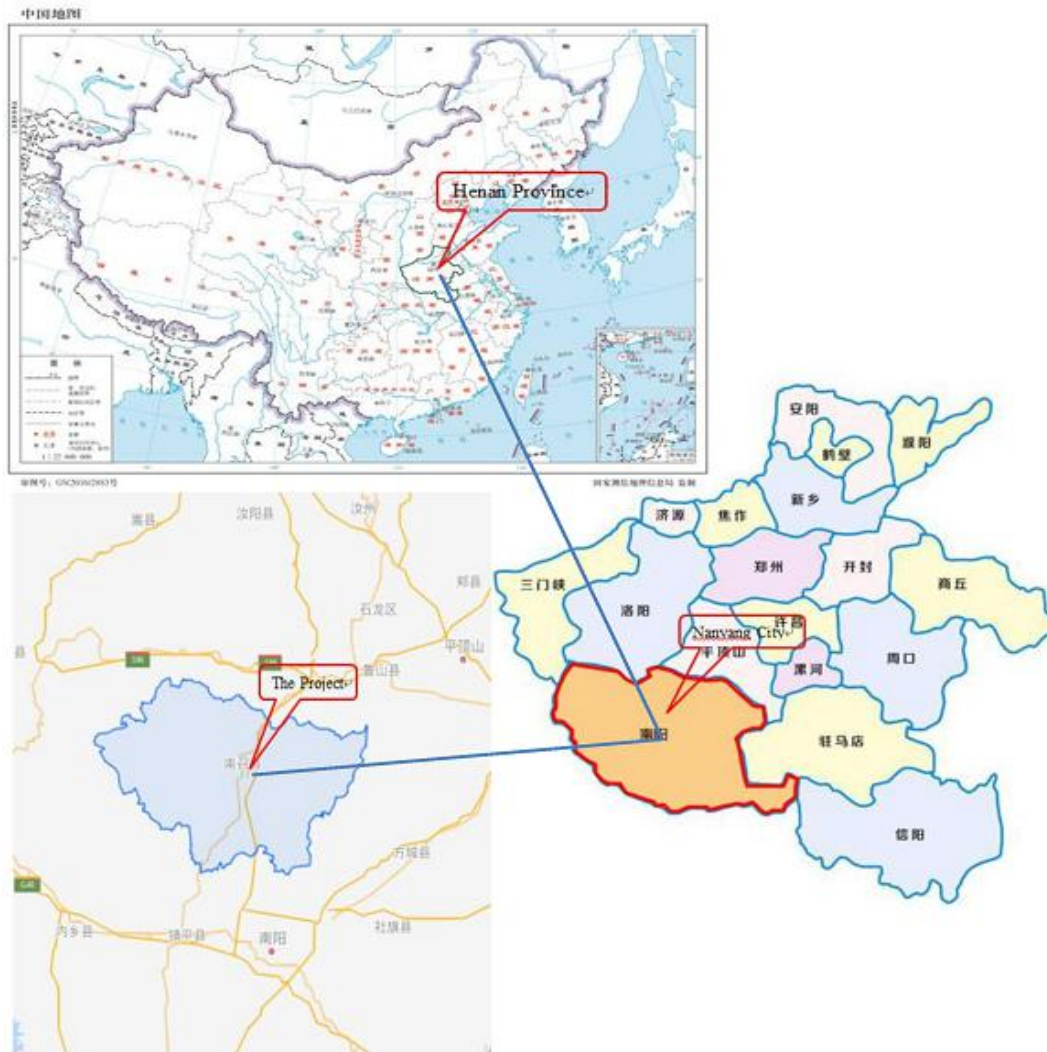


Figure 1-1. Project site in Nanzhao County, Nanyang City, Henan Province, China

1.10 CONDITIONS PRIOR TO PROJECT INITIATION

The baseline scenario is the same as the conditions existing prior to the project initiation. All sites were barren hills and wastelands at least 10 years prior to the project. The lands will remain barren without the project. Section 2.4 provides more detail information on baseline scenario.

The condition prior to the proposed carbon sequestration forestation project is summarized as follows.

Nanzhao County is located in the southwest of Henan Province, at the southern foot of Funiu Mountain and the northern margin of Nanyang Basin. It belongs to Nanyang City. Nanzhao County is high in the northwest and low in the southeast, which is roughly divided into three steps. The Funiu Mountains, formed in the east of the Qinling Mountains, stretch over 300 peaks in the northwest, southwest, north and northeast. The mountains are arched from northwest to southwest

and northeast, with the highest peak of Shiren Mountain at 2153.1 meters above sea level. The elevation is between 500 meters and 2000 meters, which is the first step. The hills in the central part of the country are undulating, some mountains are over-turning to the plain, others are open from the northwest to the southeast, and the elevation is between 200 meters and 500 meters, which is the second step. The southern part of Nanyang Basin is a plain area with an elevation below 200 meters, which is the third step. Mountain area accounted for 34.4%, hilly area 62.5%, plain area 3.1%.

The project is located on the line of Qinling-Huaihe River, an important geographical dividing line in China. It is located on the North-South intersection area, 800 mm isoprecipitation line and the intersection of humid zone and semi-humid zone. It belongs to the north subtropical monsoon continental climate and has the obvious characteristics of transition from subtropical to warm temperate zone. Winter and summer are long, spring and autumn are short, and the four seasons are distinct. The average annual temperature is 14.8 C. The temperature is the lowest in January with an average monthly temperature of 1.2 degrees Celsius. The highest temperature was in July, averaging 27.5 C per month. The average annual sunshine was 1850.5 hours. The annual average frost-free period is 219 days. The annual average precipitation is 868.8 mm, and most of the precipitation is concentrated in summer.

The main rivers in Nanzhao County belong to the Hanjiang River system, which originates from the Northwest Mountainous Areas and flows southeast, and is in the same direction in the mountains. The largest river in the territory is the Baihe River. The tributaries of the Baihe River are Huangyahe River, Yahe River, Songhe River, Guanhe River, Liushan River, Kungshan River and hundreds of its tributaries, which distribute as branches. The river runoff mainly comes from surface runoff. The average annual runoff in the county is 1.033 billion cubic meters and the runoff depth is 350 mm.

1.11 COMPLIANCE WITH LAWS, STATUTES AND OTHER REGULATORY FRAMEWORKS

The project activity is in line with the Forest Law of People's Republic of China

1.12 OWNERSHIP AND OTHER PROGRAMS

1.12.1 Project Ownership

Beijing Pingtougou Forestry Carbon Technology Development Co.,Ltd. (hereafter "the project proponent"), established in May 2008. The project proponent has the ownership and legal right of the carbon sink credit of this project.

1.12.2 Emissions Trading Programs and Other Binding Limits

N/A.

1.12.3 Other Forms of Environmental Credit

The project has not sought or received another form of GHG-related environmental credit.

1.12.4 Participation under Other GHG Programs

The project has not been registered, or is seeking registration under any other GHG programs.

1.12.5 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG programs.

1.13 ADDITIONAL INFORMATION RELEVANT TO THE PROJECT

Eligibility Criteria

N/A.

Leakage Management

According to the A/R Methodological tool “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity” (Version 02.0), leakage emission attributable to the displacement of agricultural activities due to implementation of an A/R project activity is estimated as the decrease in carbon stocks in the affected carbon pools of the land receiving the displaced activity.

There is no farming, grazing, or wood chopping taking place in the project area. In other word, the area is barren land before the project. Therefore, there would be no leakage emission attributable to the displacement of agricultural activities and grazing activities.

Thus, there is no need for leakage management within the project lifetime.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Sustainable Development

As one of the most precious ecological resources, forest is the key to biodiversity and all life forms. The protection of local forest will enrich the biodiversity and provide more opportunity for adaptive response to natural challenges and economic development (e.g. climate change). The project activity will result in significant carbon sequestration and contribute to the environment (e.g. biodiversity conservation and soil erosion control), thus contribute to sustainable development.

Further Information

There are no additional relevant legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and/or temporal information that may have a bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

2 APPLICATION OF METHODOLOGY

2.1 TITLE AND REFERENCE OF METHODOLOGY

Consolidated afforestation and reforestation baseline and monitoring methodology AR-ACM0003/Version 02.0 “Afforestation and reforestation of lands except wetlands” is applied.

<http://cdm.unfccc.int/methodologies/DB/C9QS5G3CS8FW04MYYXDFOQDPXWM4OE>

The following methodological tools, to which the selected methodology refers to, are used:

- [Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities](#) (Version 01)
- [Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities](#) (Version 04.1).

2.2 APPLICABILITY OF METHODOLOGY

Consolidated afforestation and reforestation baseline and monitoring methodology AR-ACM0003/Version 02.0 “Afforestation and reforestation of lands except wetlands” is applicable under the following conditions:

- a) The subject to the project activity does not fall in wetland category.

The satellite images show that the land subject to the project activity does not fall in wetland category.

- b) Soil disturbance attributable to the project activity does not cover more than 10 per cent of area in each of the following types of land, when these lands are included within the project boundary:

- i. Land containing organic soils.

The disturbance is cave-shaped, rather than banding. All the project land contain organic soils, but the disturbance on the soil triggered by the project activity is only 2.79%.

- ii. Land which, in the baseline, is subjected to land-use and management practices and receives inputs listed in Appendix 1 in the methodology.

Appendix 1 lists cropland in which soil disturbance is restricted. According to Participatory Rural Appraisal Report on Afforestation, the land does not contain the listed type of cropland and grassland.

Therefore, AR-ACM0003 (Version 02.0) is applicable for the proposed project.

Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (Version 01) is applicable under the following conditions:

- a) Forestation of the land within the proposed project boundary performed with or without being registered as the VCS project activity shall not lead to violation of any applicable law even if the law is not enforced.

Forestation of the land within the project boundary does not lead to violation of any applicable law.

- b) The tool is not applicable to small-scale afforestation and reforestation project activities.

The proposed project is large-scale afforestation project.

Therefore, combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (Version 01) is applicable for the proposed project.

Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities (Version 04.1) has no internal applicability conditions.

2.3 PROJECT BOUNDARY

The emissions sources included in or excluded from the project boundary are shown in the table below.

The project proponent has chosen to exclude to account for GHG emissions related to the combustion of fossil fuels, which is conservative.

Source		Gas	Included?	Justification/Explanation
Baseline	Burning of biomass	CO ₂	Excluded	Excluded per VM0003
		CH ₄	Included	Included as CO ₂ equivalent emission
		N ₂ O	Excluded	Potential emissions are negligibly small
Project	Combustion of fossil fuels (in vehicles, machinery and equipment)	CO ₂	Excluded	Potential emissions are negligibly small.
		CH ₄	Excluded	Potential emissions are negligibly small
		N ₂ O	Excluded	Potential emissions are negligibly small
	Burning of biomass	CO ₂	Excluded	Excluded per VM0003
		CH ₄	Included	Included as CO ₂ equivalent emission
		N ₂ O	Excluded	Potential emissions are negligibly small

The carbon pools included or excluded from the project boundary are shown in the table below.

Table 2-1 The Carbon Pools Selected for Accounting of Carbon Stock Changes

Carbon pools	Whether selected	Justification/Explanation
Above ground	Yes	Major carbon subject to the project activity
Below ground	Yes	Major carbon subject to the project activity
Dead wood	No	Based on IPCC guidelines, it is assumed that carbon stocks in the naturally occurring dead wood pool are equivalent in both the project and baseline scenario. Therefore, this pool is conservatively excluded.
Litter	No	Insignificant and exclusion is conservative.
Soil organic carbon	No	Insignificant and exclusion is conservative.

There will be no slash and burn site preparation, overall ploughing and flood irrigation as well as no machinery tools to be used within the project boundary. Therefore, sources of burning of woody biomass in AR-ACM0003 (Version 02.0) are not selected as emission sources for accounting.

According to the applied methodology AR-ACM0003(Version 02.0), GHG emissions resulting from removal of herbaceous vegetation, combustion of fossil fuel, fertilizer application, use of wood, decomposition of litter and fine roots of N-fixing trees, construction of access roads within the project boundary, and transportation attributable to the project activity shall be considered insignificant and therefore accounted as zero.

The project location has the following qualifications:

- All the project plots were not forestry land on January 1st 2000 and even before.
- The afforestation land ownership is clear.
- The project is aiming to protect local biodiversity, mitigate water and soil erosion, and stimulate the development of local economy.

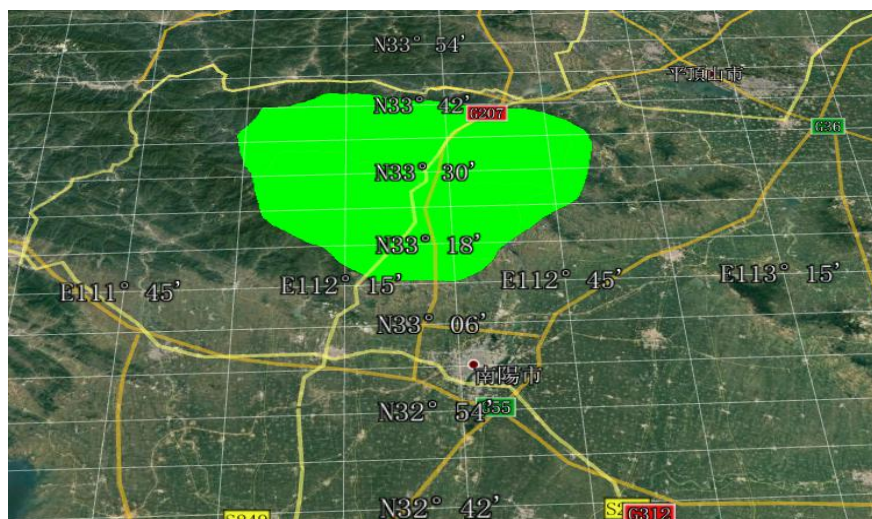


Figure 2-1. Project site in Nanzhao County, Nanyang City

The following temporal boundaries shall be defined:

The temporal boundaries are defined by the project start date and length of the project crediting period

According to VCS standard version 3.7, the start date of the project activity is 01/09/2014. The length of the project crediting period is 60 years.

The minimum duration of a monitoring period is one year and the maximum duration is 10 years.

The project proponent decides the periodicity of verifications every 5 years.

2.4 BASELINE SCENARIO

2.4.1 Selection of baseline

The baseline scenario is defined by using “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities” (Version 01).

STEP 0. Preliminary screening based on the starting date of the A/R project activity

The planting activity was conducted from 2014 to 2020, the evidence shows that the starting date of the A/R project is 01/09/2014.

Before the project implementation, the project owners conduct thorough evaluation on the project activity including the incentive from carbon trading, which indicates that incentives are seriously considered during the project implementation.

STEP 1. Identification of alternative scenarios

Sub-step 1a. Identify credible alternative land use scenarios to the proposed project activity

According to additionality tool, the alternative land use scenario of the proposed project includes:

1. Continuation of pre-project land use (i.e. Lands remain barren.)
2. Agricultural use of the land
3. Forestation of the land within the project boundary without being registered as the VCS project

In identification of the alternative land use scenario, field survey and data from the local forestry bureau has been applied. The identified scenarios are deemed realistic and credible.

Sub-step 1b: Consistency of credible land use scenarios with enforced mandatory applicable laws and regulations

National, local and sectoral land-use policies or regulations since 1980s are listed below:

China has successively issued and revised a series of laws and administrative regulations related to forestry, such as the Regulations for Implementing the Forest Law.

To facilitate the restoration of forest resources, Chinese government has launched several programs over the past years, such as the Grain for Green Program (started in 2001) that subsidizes farmers to convert degraded cropland to forests, the Natural Forest Conservation Program (launched in 1998), the Nature Reserve Development and Wild Conservation Program (started in 2000), etc.

Although these programs had set overall development goals for forestry development and were started before the adoption by the COP of the CDM M&P (/decision 17/CP.7, 11 November 2001), none of the programs mandate the forestation on barren lands. Moreover, these programs have not been written in laws. Whether these programs can meet the initial targets highly depends on whether the program is fully funded, but the funding gap is very big. Finally, the project area is very remote, which makes the timber less competitive in the market. Thus, the project activity can hardly get any subsidy from the government. Thus Scenario 1 remains possible baseline scenario.

According to the land planning, the afforestation activity location is legally defined as forestry land. Farming and grazing is not allowed in these plots. Thus the second scenario “agricultural use of land” is not feasible.

Scenario 3 faces the investment and technical barrier which will be discussed in the next section. However it does not violate any existing enforced mandatory applicable laws and regulations.

In sum, scenario 1 and 3 are in compliance with mandatory legislation and regulations.

STEP 2. Barrier analysis

Sub-step 2a: Identification of barriers that would prevent the implementation of at least one alternative land use scenario

1. Investment barrier

Debt funding not available for the land use scenarios. Commercial loan from banks for the purpose of afforestation is very unlikely due to the high risk and the economical unattractiveness in the context of remote lands.

In addition, no credit mechanisms are in place for farmers to make long term investment in plantation forestry. The income of farmers in the project area is lower than the general level of local townships and counties.

The project activity aims to enhance biodiversity conservation, improve soil and water conservation and mitigate climate change. All the trees planted for this project would not be sold in the future. Therefore, there would be no direct benefits from lumber sales. The project definitely has the financial barrier.

2. Technological barriers

Local farmers lack access to good quality saplings or seedlings as well as the necessary tending and forest management technique. They also lack the skills needed to produce high quality seedlings and successful tree planting, and lack the skills needed to prevent planted trees from being subject to fire, pest and disease attack. In addition, the lack of organizational instruments also prevents them from overcoming technological barriers.

The technical barriers are summarized as 1) lack of access to planting materials; 2) lack of silvicultural and forest management technology; and 3) lack of skilled or properly trained labour force. If planting trees within the project boundary without registration as a VCS project (scenario 3), these technical barriers would be applied to the project owner, and lead to the failure of the project.

Sub-step 2b: Elimination of land use scenarios that are prevented by the identified barriers.

Scenario 1 does not require extra investment or labour force. Thus it is not prevented by any of the identified barriers.

Scenario 3 faces the investment and technical barriers.

In sum, Scenario 3 is not feasible. Scenario 1, continuation of pre-project use (i.e. lands remain barren), remains the possible baseline scenario.

STEP 3. Investment analysis (if needed)

Scenario 1 remains the only possible baseline scenario, which makes investment analysis not necessary.

STEP 4. Common practice analysis

According to the “Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities” (version 3.0). “Similar activities are defined as that which are of similar scale, take place in a comparable environment, inter alia, with respect to the regulatory framework and are undertaken in the relevant geographical area, subject to further guidance by the underlying methodology”. China has a vast territory, the development policies and economic environment for projects in each province of China are not same. The investment climate varies considerably from province to province depending on the local conditions. The Project is located in Henan Province. However, the geographic and geomorphic conditions are totally different in the whole province. And by searching the VCS, CDM websites, there is no similar project without applying the VCS, CDM or other voluntary emission reduction project.

Therefore, according to the analysis above, the similar activities which haven't applied for the VCS are not common practice in Henan.

Thus, the proposed project is not a common practice, the proposed project has additionality.

2.4.2 Stratification

Based on the availability of data regarding the nature and composition of forest stocks in the project area, stratification is developed on the basis of existing vegetation stratification. The purpose of strata is to improve accuracy and reduce the sampling cost. The strata is usually based on the tree species, age and canopy density, but it does not mean all these factors should be considered for all projects, more strata means more workload and cost. For this project, the factor of species for strata could reduce the variation within the same stratum and reach the accuracy level of 90% under certain degree of freedom. So the strata are reasonable and feasible.

Table 2-2 shows the 20 stratas specified based on the tree species and planting time.

Table 2-2 Tree strata

Category	Years	Afforestation mode	Area (mu)
PROJ-1	2014	I	8496
PROJ-2	2014	II	33400
PROJ-3	2014	III	31423
PROJ-4	2015	I	7439
PROJ-5	2015	II	55628
PROJ-6	2015	III	14263
PROJ-7	2016	I	12715
PROJ-8	2016	II	45000
PROJ-9	2016	III	9014
PROJ-10	2017	I	10584
PROJ-11	2017	III	14514
PROJ-12	2018	I	18440
PROJ-13	2018	II	26796
PROJ-14	2018	III	22990
PROJ-15	2019	I	10000
PROJ-16	2019	II	25000
PROJ-17	2019	III	15000
PROJ-18	2020	I	10000
PROJ-19	2020	II	25000
PROJ-20	2020	III	15000
Total			410,702

The main afforestation tree species in this project are Magnolia and Oak tree. The afforestation model is artificial afforestation, including pure and mixed forests, as shown in the table 2-3 below.

Table 2-3 Afforestation Model Table

Afforestation model number	Afforestation tree species allocation	Mixed mode	Initial planting density (plant/mu)
I	10 Magnolia	Pure forest	56
II	10 Oak tree	Pure forest	111
III	5 Magnolia 5 Oak tree	Mixed forest	100

2.5 ADDITIONALITY

Additionality has been fully analysed in the above section 2.4 Baseline Senario with “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities” (Version 01).

The proposed project is additional.

2.6 METHODOLOGY DEVIATIONS

No deviations from the procedures indicated by the methodology have been made.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 BASELINE EMISSIONS

Baseline net GHG removals by sinks

As described above, the baseline scenario is the continuation of existing land use i.e. lands remain barren. Based on the applied methodology AR-ACM0003 (Version 02.0), the baseline net GHG removals by sinks is estimated as follows:

$$\Delta C_{BSL,t} = \Delta C_{TREE-BSL,t} + \Delta C_{SHRUB-BSL,t} + \Delta C_{DW-BSL,t} + \Delta C_{LI-BSL,t}$$

Where:

$$\begin{aligned} \Delta C_{BSL,t} &= \text{Baseline net GHG removals by sinks in year } t; t \text{ CO}_2\text{-e} \\ \Delta C_{TREE-BSL,t} &= \text{Change in carbon stock in baseline tree biomass within the project boundary in year } t, \text{ as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”}; t \text{ CO}_2\text{-e} \end{aligned}$$

$\Delta C_{\text{SHRUB-BSL},t}$	=	Change in carbon stock in baseline shrub biomass within the project boundary, in year t , as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; $t \text{ CO}_2\text{-e}$
$\Delta C_{\text{DW-BSL},t}$	=	Change in carbon stock in baseline dead wood biomass within the project boundary, in year t , as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; $t \text{ CO}_2\text{-e}$
$\Delta C_{\text{LI-BSL},t}$	=	Change in carbon stock in baseline litter biomass within the project boundary, in year t , as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; $t \text{ CO}_2\text{-e}$

With baseline scenario, dead wood biomass and litter biomass would not be changed by local farmers. All the plots in this country have been barren and do not change after 1970s and before the project. Thus, the change in carbon stock in baseline dead wood biomass and litter biomass can be negligible.

$$\Delta C_{\text{BSL},t} = 0$$

Therefore, the baseline net GHG removal by sinks is 0..

3.2 PROJECT EMISSIONS

According to the applied methodology AR-ACM0003 (Version 02.0), GHG emissions resulting from removal of herbaceous vegetation, combustion of fossil fuel, fertilizer application, use of wood, decomposition of litter and fine roots of N-fixing trees, construction of access roads within the project boundary, and transportation attributable to the project activity shall be considered insignificant and therefore accounted as zero.

The project net GHG removals by sinks shall be calculated as the sum of the changes in carbon stocks in the project minus the increase in non-CO₂ GHG emissions within the project boundary, which is shown as follows:

$$\Delta C_{\text{PRJ},t} = \Delta C_{\text{P},t} - \text{GHG}_{\text{E},t}$$

Where:

$\Delta C_{\text{PRJ},t}$	=	Project net GHG removals by sinks, in year t ; $t \text{ CO}_2\text{-e}$
$\Delta C_{\text{P},t}$	=	Change in the carbon stocks in project, occurring in the selected carbon pools, in year t ; $t \text{ CO}_2\text{-e}$
$\text{GHG}_{\text{E},t}$	=	Increase in non-CO ₂ GHG emissions within the project boundary as a result of the implementation of the A/R CDM project activity, in year t ,

as estimated in the tool “Estimation of non-CO₂ GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity”; t CO₂-e

According to the tool, the use of fire for site preparation and/or to clear the land of harvest residue prior to replanting is specifically excluded from the project management and therefore non-CO₂ GHG emissions are estimated as zero.

$$GHG_{E,t} = 0$$

Change in the carbon stocks in project, occurring in the selected carbon pools in year t shall be calculated as follows:

$$\Delta C_{P,t} = \Delta C_{TREE-PRJ,t} + \Delta C_{SHRUB-BSL,t} + \Delta C_{DW-BSL,t} + \Delta C_{LI-BSL,t} + \Delta SOC_{AL,t}$$

Where:

$\Delta C_{P,t}$	=	Change in the carbon stocks in project, occurring in the selected carbon pools, in year t; t CO ₂ -e
$\Delta C_{TREE-PRJ,t}$	=	Change in carbon stock in tree biomass in project in year t, as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO ₂ -e
$\Delta C_{SHRUB-BSL,t}$	=	Change in carbon stock in shrub biomass in project in year t, as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO ₂ -e
$\Delta C_{DW-BSL,t}$	=	Change in carbon stock in dead wood in project in year t, as estimated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”; t CO ₂ -e
$\Delta C_{LI-BSL,t}$	=	Change in carbon stock in litter in project in year t, as estimated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”; t CO ₂ -e
$\Delta SOC_{AL,t}$	=	Change in carbon stock in SOC in project, in year t, in areas of land meeting the applicability conditions of the tool “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”, as estimated in the same tool; t CO ₂ -e

The only change within each project stratum are planted trees. In other words, change in carbon stock above the ground is the only change to be considered in the project. The tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activity” (Version 04.1) is used to estimate the change in carbon stock above the ground. A summary of the main factors used for ex-ante estimations and each source of data are presented below.

$$\Delta C_{TREE_PRJ,t} = C_{TREE,t} - C_{TREE,t-1}$$

$$C_{TREE,t} = CO_2/C * B_{TREE,t} * CF_j$$

Where:

CF_j = Carbon fraction of tree biomass for species or
group of species j

$$CO_2/C = 44/12$$

$$B_{TREE,t} = V_{TREE,t} * D_j * BEF_j * (1+R_j)$$

Where:

$B_{TREE,t}$ = biomass of trees within the project boundary at time t; tonne dry materials

$V_{TREE,t}$ = merchantable volume of trees, at time t; m³

D_j = average wood density of species j; tonne dry materials/m³

BEF_j = biomass expansion factor for species j R_j = root-shoot ratio of species j

$$V_{TREE,t} = A_i * V_{it} * N_{it}$$

Where:

A_i = area of category i; hectare (ha)

V_{it} = average merchantable volume of one tree in category i, at time t; m³/tree

N_{it} = tree number per ha in category i, at time t; tree/ha

According to the method, the associated uncertainty of the change in carbon stock in trees is estimated as follows:

$$\Delta C_{TREE} = \frac{44}{12} \times CF_{TREE} \times \Delta B_{TREE}$$

$$\Delta B_{TREE} = A \times \Delta b_{TREE}$$

$$\Delta b_{TREE} = \sum_{i=1}^M w_i \times \Delta b_{TREE,i}$$

$$u_{\Delta C} = \frac{t_{VAL} \times \sqrt{\sum_{i=1}^M w_i^2 \times \frac{s_{\Delta i}^2}{n_i}}}{|\Delta b_{TREE}|}$$

Where:

- ΔC_{TREE} = Change in carbon stock in trees between two successive measurements; t CO₂-e
- CF_{TREE} = Carbon fraction of tree biomass; t C (t d.m.)-1
A default value of 0.5 is used unless transparent and verifiable information can be provided to justify a different value.
- ΔB_{TREE} = Change in tree biomass within the biomass estimation strata; t d.m.
- A = Sum of areas of the biomass estimation strata; ha
- Δb_{TREE} = Mean change in tree biomass per hectare within the biomass estimation strata; t d.m. ha⁻¹
- W_i = Ratio of the area of stratum i to the sum of areas of biomass estimation strata (i.e. $W_i = A_i / A$); dimensionless
- $\Delta b_{TREE,i}$ = Mean change in carbon stock per hectare in tree biomass in stratum i; t d.m. ha⁻¹
- $u_{\Delta C}$ = Uncertainty in ΔC_{TREE}
- t_{val} = Two-sided Student's t-value for a confidence level of 90 per cent and degrees of freedom equal to $n - M$, where n is total number of sample plots within the tree biomass estimation strata, and M is the total number of tree biomass estimation strata
- $S_{\Delta i}^2$ = Variance of mean change in tree biomass per hectare in stratum i; (t d.m. ha⁻¹)²
- n_i = Number of sample plots, in stratum i, in which tree biomass was remeasured

According to the tool, only sampling uncertainty is assessed and controlled. Uncertainty in values obtained from direct measurement or values derived from models is not quantified. The uncertainty should be managed through application of appropriate quality assurance and quality control (QA/QC) methods. For the project, all parameters were estimated based on the growth model and not measured at ex-ante stage. At ex-post stage, sampling uncertainty does not exist since the samples have been selected at the beginning. The sample is rectangle land with 20m*20m (400m²) each.

Therefore, uncertainty analysis is not necessary for the project.

The tree species adopted in the project are Magnolia and Oak tree. Local growth curves are used to estimate the average merchantable volume of one tree (V_{it})

Table 3-1 Wood density, BEF, Root-shoot ratio and carbon fraction used in the proposed project activity

Parameter	factor		Source
	Magnolia	Oak tree	

Wood density (tonnes d.m.m ⁻³)	0.598	0.676	"Land Use Change and Forestry GHG Inventory(2013)" of "Second National Information Notification on China Climate Change"
BEF	1.765	1.355	
Root-shoot ratio	0.398	0.292	
CF	0.5	0.5	The IPCC default value of 0.5 t C t ⁻¹ .

According to the section 1.8 of the description of the project activity, the aboveground biomass can be categorized into 20 groups.

Table 3-2 20 Groups of The Project

Category	Years	Afforestation mode	Area (mu)
Proj -1	2014	I	8496
Proj -2	2014	II	33400
Proj -3	2014	III	31423
Proj -4	2015	I	7439
Proj -5	2015	II	55628
Proj -6	2015	III	14263
Proj -7	2016	I	12715
Proj -8	2016	II	45000
Proj -9	2016	III	9014
Proj -10	2017	I	10584
Proj -11	2017	III	14514
Proj -12	2018	I	18440
Proj -13	2018	II	26796
Proj -14	2018	III	22990
Proj -15	2019	I	10000
Proj -16	2019	II	25000
Proj -17	2019	III	15000
Proj -18	2020	I	10000
Proj -19	2020	II	25000
Proj -20	2020	III	15000

Since the project activity involves different size saplings, 20 different biomass volume estimation models are estimated based on different sapling age and tree species.

Table 3-3 Volume of Different Tree Species at Different Ages

Stand age	Magnolia	Oak tree
1	0.000000391	0.0002520
2	0.000006896	0.0008656
3	0.000035982	0.0017816
4	0.000114037	0.0029734
5	0.000275047	0.0044236
6	0.000558226	0.0061199
7	0.001005847	0.0080525
8	0.001661370	0.0102134
9	0.002567885	0.0125962
10	0.003766855	0.0151950
11	0.005297131	0.0180050
12	0.007194217	0.0210217
13	0.009489746	0.0242412
14	0.012211135	0.0276600
15	0.015381397	0.0312749
16	0.019019073	0.0350829
17	0.023138270	0.0390813
18	0.027748779	0.0432675
19	0.032856256	0.0476393
20	0.038462451	0.0521944
21	0.044565470	0.0569308
22	0.051160061	0.0618466
23	0.058237912	0.0669398
24	0.065787962	0.0722089
25	0.073796699	0.0776521
26	0.082248469	0.0832679
27	0.091125761	0.0890548
28	0.100409490	0.0950115
29	0.110079262	0.1011364
30	0.120113624	0.1074285
31	0.130490297	0.1138864
32	0.141186394	0.1205089
33	0.152178613	0.1272949
34	0.163443425	0.1342432
35	0.174957229	0.1413530
36	0.186696509	0.1486230
37	0.198637956	0.1560523
38	0.210758589	0.1636399
39	0.223035856	0.1713850
40	0.235447719	0.1792866
41	0.247972732	0.1873439
42	0.260590105	0.1955560
43	0.273279752	0.2039222
44	0.286022341	0.2124415

45	0.298799319	0.2211133
46	0.311592947	0.2299367
47	0.324386308	0.2389111
48	0.337163327	0.2480358
49	0.349908771	0.2573100
50	0.362608249	0.2667331
51	0.375248211	0.2763044
52	0.387815935	0.2860232
53	0.400299518	0.2958890
54	0.412687857	0.3059012
55	0.424970635	0.3160591
56	0.437138296	0.3263621
57	0.449182026	0.3368097
58	0.461093730	0.3474013
59	0.472866005	0.3581363
60	0.484492114	0.3690143
61	0.495965962	0.3800347

Taking all the above information into the formula, we reach the table below.

Table 3-4 The GHG Removals by Sinks of the Project Activity

Time	Annual Variation of Forest Biomass Carbon Storage (tCO ₂ e·a ⁻¹)	Cumulative annual variation of forest biomass carbon storage (tCO ₂ e)
2014.9.1-2015.8.31	9,733	9,733
2015.9.1-2016.8.31	23,081	32,814
2016.9.1-2017.8.31	37,226	70,040
2017.9.1-2018.8.31	46,676	116,716
2018.9.1-2019.8.31	62,385	179,101
2019.9.1-2020.8.31	83,868	262,969
2020.9.1-2021.8.31	98,217	361,186
2021.9.1-2022.8.31	113,831	475,017
2022.9.1-2023.8.31	130,972	605,989
2023.9.1-2024.8.31	148,648	754,637
2024.9.1-2025.8.31	166,934	921,571
2025.9.1-2026.8.31	185,853	1,107,424
2026.9.1-2027.8.31	205,389	1,312,813
2027.9.1-2028.8.31	225,500	1,538,313
2028.9.1-2029.8.31	246,126	1,784,439
2029.9.1-2030.8.31	267,191	2,051,630
2030.9.1-2031.8.31	288,612	2,340,242
2031.9.1-2032.8.31	310,302	2,650,544
2032.9.1-2033.8.31	332,170	2,982,714
2033.9.1-2034.8.31	354,127	3,336,841
2034.9.1-2035.8.31	376,087	3,712,928
2035.9.1-2036.8.31	397,967	4,110,895
2036.9.1-2037.8.31	419,690	4,530,585
2037.9.1-2038.8.31	441,183	4,971,768
2038.9.1-2039.8.31	462,381	5,434,149
2039.9.1-2040.8.31	483,224	5,917,373
2040.9.1-2041.8.31	503,660	6,421,033

2041.9.1-2042.8.31	523,642	6,944,675
2042.9.1-2043.8.31	543,132	7,487,807
2043.1.1-2044.8.31	562,094	8,049,901
2044.9.1-2045.8.31	580,502	8,630,403
2045.9.1-2046.8.31	598,334	9,228,737
2046.9.1-2047.8.31	615,572	9,844,309
2047.9.1-2048.8.31	632,206	10,476,515
2048.9.1-2049.8.31	648,227	11,124,742
2049.9.1-2050.8.31	663,632	11,788,374
2050.9.1-2051.8.31	678,422	12,466,796
2051.9.1-2052.8.31	692,601	13,159,397
2052.9.1-2053.8.31	706,175	13,865,572
2053.1.1-2054.8.31	719,153	14,584,725
2054.9.1-2055.8.31	731,548	15,316,273
2055.9.1-2056.8.31	743,373	16,059,646
2056.9.1-2057.8.31	754,643	16,814,289
2057.9.1-2058.8.31	765,376	17,579,665
2058.9.1-2059.8.31	775,588	18,355,253
2059.9.1-2060.8.31	785,300	19,140,553
2060.9.1-2061.8.31	794,530	19,935,083
2061.9.1-2062.8.31	803,300	20,738,383
2062.9.1-2063.8.31	811,629	21,550,012
2063.1.1-2064.8.31	819,538	22,369,550
2064.9.1-2065.8.31	827,049	23,196,599
2065.9.1-2066.8.31	834,182	24,030,781
2066.9.1-2067.8.31	840,958	24,871,739
2067.9.1-2068.8.31	847,398	25,719,137
2068.9.1-2069.8.31	853,521	26,572,658
2069.9.1-2070.8.31	859,348	27,432,006
2070.9.1-2071.8.31	864,897	28,296,903
2071.9.1-2072.8.31	870,189	29,167,092
2072.9.1-2073.8.31	875,239	30,042,331
2073.9.1-2074.8.31	880,068	30,922,399
total	30,922,399	30,922,399

3.3 LEAKAGE

According to the applied methodology AR-ACM0003 (Version 2.0.0), leakage emission is estimated as follows:

$$LK_t = LK_{AGRIC,t}$$

Where:

$$LK_t = \text{GHG emissions due to leakage, in year t; t CO}_2\text{-e}$$

$$LK_{AGRIC,t} = \text{Leakage due to the displacement of agricultural activities in Year t, as estimated the tool "Estimation of the increase in GHG"}$$

emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity"; t CO₂-e

According to the A/R Methodological tool "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity", leakage emission resulting from displacement of the activities is composed of decrease in carbon stock in the carbon pools of the land and change in soil organic carbon stock due to land-use change in the land.

$$LK_{AGRIC,t} = \frac{44}{12} \times (\Delta SOC_{LUC,t} + \Delta C_{BIOMASS,t})$$

Where:

$LK_{AGRIC,t}$ = Leakage due to the displacement of agricultural activities in year t; t CO₂-e

$\Delta SOC_{LUC,t}$ = Decrease in carbon stock in the carbon pools of the land receiving the activity displaced in year t; t d.m

$\Delta C_{BIOMASS,t}$ = Change in soil organic carbon (SOC) stock due to land-use change in the land receiving the displaced activity in year t; tC ha

The project was implemented by manual operation, rather than mechanical operation. Besides, no weeding, chopping, pruning, intermediate cutting activities are going to be conducted during the crediting period because of the natural condition, the economic condition and the slow growth pattern. Fertilization and watering are not going to take place, neither.

Therefore, there is no expected leakage due to decrease in carbon stock in the carbon pools of the land and change in soil organic carbon stock. In other words, there is no expected leakage due to the displacement of agricultural activity from the project activity.

Therefore, leakage is zero for the proposed project..

3.4 NET GHG EMISSION REDUCTIONS AND REMOVALS

The net anthropogenic GHG removals by the project shall be calculated as follows:

$$\Delta C_{AR,t} = \Delta C_{PRJ,t} - \Delta C_{BSL,t} - LK_t$$

Where:

$\Delta C_{AR,t}$ = Net anthropogenic GHG removals by sinks, in year t ; t CO₂-e

$\Delta C_{LPRJ,t}$ = Actual net GHG removals by sinks, in year t ; t CO₂-e

$\Delta C_{BSL,t}$ = Baseline net GHG removals by sinks, in year t ; t CO₂-e

LK_t = GHG emissions due to leakage, in year t ; t CO₂-e

From the previous calculation on baseline emissions and leakage emissions, we learn that estimated baseline emissions is 0 tCO₂-e for the project, and estimated leakage emissions is 0 tCO₂-e for the project.

The net anthropogenic GHG removals by the project are summarized below.

Table 3-5 The Net Anthropogenic GHG Removals by the Project

Year	Estimated project emissions or removals (tCO ₂ e)	Estimated baseline emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated GHG emission reductions or removals (tCO ₂ e)	Estimated cumulative GHG emission reductions or removals (tCO ₂ e)
2014.9.1-2015.8.31	9,733	0	0	9,733	9,733
2015.9.1-2016.8.31	23,081	0	0	23,081	32,814
2016.9.1-2017.8.31	37,226	0	0	37,226	70,040
2017.9.1-2018.8.31	46,676	0	0	46,676	116,716
2018.9.1-2019.8.31	62,385	0	0	62,385	179,101
2019.9.1-2020.8.31	83,868	0	0	83,868	262,969
2020.9.1-2021.8.31	98,217	0	0	98,217	361,186
2021.9.1-2022.8.31	113,831	0	0	113,831	475,017
2022.9.1-2023.8.31	130,972	0	0	130,972	605,989
2023.9.1-2024.8.31	148,648	0	0	148,648	754,637
2024.9.1-2025.8.31	166,934	0	0	166,934	921,571
2025.9.1-2026.8.31	185,853	0	0	185,853	1,107,424
2026.9.1-2027.8.31	205,389	0	0	205,389	1,312,813
2027.9.1-2028.8.31	225,500	0	0	225,500	1,538,313

2028.9.1- 2029.8.31	246,126	0	0	246,126	1,784,439
2029.9.1- 2030.8.31	267,191	0	0	267,191	2,051,630
2030.9.1- 2031.8.31	288,612	0	0	288,612	2,340,242
2031.9.1- 2032.8.31	310,302	0	0	310,302	2,650,544
2032.9.1- 2033.8.31	332,170	0	0	332,170	2,982,714
2033.9.1- 2034.8.31	354,127	0	0	354,127	3,336,841
2034.9.1- 2035.8.31	376,087	0	0	376,087	3,712,928
2035.9.1- 2036.8.31	397,967	0	0	397,967	4,110,895
2036.9.1- 2037.8.31	419,690	0	0	419,690	4,530,585
2037.9.1- 2038.8.31	441,183	0	0	441,183	4,971,768
2038.9.1- 2039.8.31	462,381	0	0	462,381	5,434,149
2039.9.1- 2040.8.31	483,224	0	0	483,224	5,917,373
2040.9.1- 2041.8.31	503,660	0	0	503,660	6,421,033
2041.9.1- 2042.8.31	523,642	0	0	523,642	6,944,675
2042.9.1- 2043.8.31	543,132	0	0	543,132	7,487,807
2043.1.1- 2044.8.31	562,094	0	0	562,094	8,049,901
2044.9.1- 2045.8.31	580,502	0	0	580,502	8,630,403
2045.9.1- 2046.8.31	598,334	0	0	598,334	9,228,737
2046.9.1- 2047.8.31	615,572	0	0	615,572	9,844,309
2047.9.1- 2048.8.31	632,206	0	0	632,206	10,476,515
2048.9.1- 2049.8.31	648,227	0	0	648,227	11,124,742
2049.9.1- 2050.8.31	663,632	0	0	663,632	11,788,374
2050.9.1- 2051.8.31	678,422	0	0	678,422	12,466,796
2051.9.1- 2052.8.31	692,601	0	0	692,601	13,159,397
2052.9.1- 2053.8.31	706,175	0	0	706,175	13,865,572
2053.1.1- 2054.8.31	719,153	0	0	719,153	14,584,725
2054.9.1- 2055.8.31	731,548	0	0	731,548	15,316,273
2055.9.1-	743,373	0	0	743,373	16,059,646

2056.8.31					
2056.9.1-2057.8.31	754,643	0	0	754,643	16,814,289
2057.9.1-2058.8.31	765,376	0	0	765,376	17,579,665
2058.9.1-2059.8.31	775,588	0	0	775,588	18,355,253
2059.9.1-2060.8.31	785,300	0	0	785,300	19,140,553
2060.9.1-2061.8.31	794,530	0	0	794,530	19,935,083
2061.9.1-2062.8.31	803,300	0	0	803,300	20,738,383
2062.9.1-2063.8.31	811,629	0	0	811,629	21,550,012
2063.1.1-2064.8.31	819,538	0	0	819,538	22,369,550
2064.9.1-2065.8.31	827,049	0	0	827,049	23,196,599
2065.9.1-2066.8.31	834,182	0	0	834,182	24,030,781
2066.9.1-2067.8.31	840,958	0	0	840,958	24,871,739
2067.9.1-2068.8.31	847,398	0	0	847,398	25,719,137
2068.9.1-2069.8.31	853,521	0	0	853,521	26,572,658
2069.9.1-2070.8.31	859,348	0	0	859,348	27,432,006
2070.9.1-2071.8.31	864,897	0	0	864,897	28,296,903
2071.9.1-2072.8.31	870,189	0	0	870,189	29,167,092
2072.9.1-2073.8.31	875,239	0	0	875,239	30,042,331
2073.9.1-2074.8.31	880,068	0	0	880,068	30,922,399
Total					30,922,399
Average					515,373

4 MONITORING

4.1 DATA AND PARAMETERS AVAILABLE AT VALIDATION

Data / Parameter	Ai
Data unit:	ha
Description:	Area of category i

Source of data:	Monitoring of boundaries is done using a Geographical Information System (GIS) which allows for integrating data from different sources (including GPS coordinates and Remote
Value applied:	The difference among planting category is tree species of Magnolia and Oak tree. Tree plantation within each category is the same. The area of each category (A_i) is listed below. The area of Magnolia is 77,674 mu ; the area of Oak tree is 210,824 mu ; the area of Mixed tree is 122,204 mu .
Justification of choice of data or description of measurement methods and	N/A
Purpose of Data	The parameter is used to calculate biomass of trees within the boundary and then calculate baseline emissions and project emissions. $V_{TREE,t} = A_i \cdot V_{it} \cdot N_{it}$ $B_{TREE,t} = V_{TREE,t} \cdot D_j \cdot BEF_j \cdot (1+R_j)$ $\Delta C_{TREE,t} = C_{TREE,t} = 44/12 \cdot B_{TREE,t} \cdot CF_j$
Comments	N/A

Data / Parameter	BEF _j
Data unit	Dimensionless
Description	Biomass expansion factor for conversion of stem biomass to above-ground biomass
Source of data	"Land Use Change and Forestry GHG Inventory(2013)" of "Second National Information Notification on China Climate Change"
Value applied:	Magnolia : 1.765 Oak tree: 1.56
Justification of choice of data or description of measurement methods and	N/A
Purpose of Data	The parameter is used to calculate biomass of trees within the boundary and then calculate baseline emissions and project emissions. $B_{TREE,t} = V_{TREE,t} \cdot D_j \cdot BEF_j \cdot (1+R_j)$ $\Delta C_{TREE,t} = C_{TREE,t} = 44/12 \cdot B_{TREE,t} \cdot CF_j$
Comments	N/A

Data / Parameter	CF _j
------------------	-----------------

Data unit	$t\ C\ t^{-1}\ d.m.$
Description	Carbon fraction of tree biomass for species or group of species j
Source of data	The IPCC default value of $0.5\ t\ C\ t^{-1}\ d.m.$
Value applied:	Magnolia : 0.5 Oak tree: 0.5
Justification of choice of data or description of measurement methods and	N/A
Purpose of Data	The parameter is used to calculate baseline emissions and project emissions. $\Delta CTREE_t = CTREE_t = 44/12 * BTREE_t * CF_j$
Comments	N/A

Data / Parameter	D_j
Data unit	$t\ d.m.m^{-3}$
Description	Basic wood density
Source of data	"Land Use Change and Forestry GHG Inventory(2013)" of "Second National Information Notification on China Climate Change"
Value applied:	Magnolia : 0.598 Oak tree: 0.676
Justification of choice of data or description of measurement methods and	N/A
Purpose of Data	The parameter is used to calculate biomass of trees within the boundary and then calculate baseline emissions and project emissions. $BTREE_t = VTREE_t * D_j * BEF_j * (1+R_j)$ $\Delta CTREE_t = CTREE_t = 44/12 * BTREE_t * CF_j$
Comments	N/A

Data / Parameter	R_j
Data unit	Dimensionless
Description	Root-shoot ratio
Source of data	"Land Use Change and Forestry GHG Inventory(2013)" of "Second National Information Notification on China Climate Change"
Value applied:	Magnolia : 0.398 Oak tree: 0.292

Justification of choice of data or description of measurement methods and	N/A
Purpose of Data	The parameter is used to calculate biomass of trees within the boundary and then calculate baseline emissions and project emissions. $BTREE_t = VTREE_t * D_j * BEF_j * (1+R_j)$ $\Delta CTREE_t = CTREE_t = 44/12 * BTREE_t * CF_j$
Comments	N/A

Data / Parameter	Vit
Data unit	m ³ /tree
Description	average merchantable volume of one tree in category i, at time t
Source of data	Calculated from the growth curve derived from Liu Xingcong, etc
Value applied:	N/A
Justification of choice of data or description of measurement methods and	N/A
Purpose of Data	The parameter is used to calculate biomass of trees within the boundary and then calculate baseline emissions and project emissions. $VTREE_t = A_i * Vit * Nit$ $BTREE_t = VTREE_t * D_j * BEF_j * (1+R_j)$ $\Delta CTREE_t = CTREE_t = 44/12 * BTREE_t * CF_j$
Comments	N/A

4.2 DATA AND PARAMETERS MONITORED

Data / Parameter	D
Data unit	cm
Description	Diameter at breast height of tree
Source of data	Field measurements in sample plots

Description of measurement methods and procedures to be applied	Usually the diameter at breast height of the tree, but it could be any other diameter or dimensional measurement (e.g. basal diameter, root-collar diameter, basal area, etc.) applicable for the model or data source used. Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF						
Frequency of monitoring/recording	Before every verification event						
Value applied:	N/A						
Monitoring equipment	N/A						
QA/QC procedures to be applied	Quality control/quality assurance (QA/QC) procedures prescribed under National Forest Inventory are applied. In absence of these, QA/QC procedures from published handbooks or from IPCC GPG LULUCF 2003 may be applied.						
Purpose of data	The parameter is used to calculate volume of trees, and then calculate project removals. <table border="1"> <tr> <td>Tree Specie</td><td>The Volume of the Commercial Component of Trees</td></tr> <tr> <td>Magnolia</td><td>$V=0.9741*(1-e^{-0.0314t})^{4.2366}$</td></tr> <tr> <td>Oak tree</td><td>$V=0.000252*t^{1.7803}$</td></tr> </table>	Tree Specie	The Volume of the Commercial Component of Trees	Magnolia	$V=0.9741*(1-e^{-0.0314t})^{4.2366}$	Oak tree	$V=0.000252*t^{1.7803}$
Tree Specie	The Volume of the Commercial Component of Trees						
Magnolia	$V=0.9741*(1-e^{-0.0314t})^{4.2366}$						
Oak tree	$V=0.000252*t^{1.7803}$						
Calculation method	N/A						
Comments	N/A						

Data / Parameter	H
Data unit	m
Description	Height of trees
Source of data	Field measurements in sample plots
Description of measurement methods and procedures to be applied	Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied.
Frequency of monitoring/recordin	Before every verification event
Value applied:	N/A
Monitoring equipment	N/A

QA/QC procedures to be applied	Quality control/quality assurance (QA/QC) procedures prescribed under National Forest Inventory are applied. In absence of these, QA/QC procedures from published handbooks or from IPCC GPG LULUCF 2003 may be applied.						
Purpose of data	The parameter is used to calculate volume of trees, and then calculate project removals. <table border="1"> <tr> <td>Tree Speci</td><td>The Volume of the Commercial Component of Trees</td></tr> <tr> <td>Magnolia</td><td>$V=0.9741*(1-e^{-0.0314t})^{4.2366}$</td></tr> <tr> <td>Oak tree</td><td>$V=0.000252*t^{1.7803}$</td></tr> </table>	Tree Speci	The Volume of the Commercial Component of Trees	Magnolia	$V=0.9741*(1-e^{-0.0314t})^{4.2366}$	Oak tree	$V=0.000252*t^{1.7803}$
Tree Speci	The Volume of the Commercial Component of Trees						
Magnolia	$V=0.9741*(1-e^{-0.0314t})^{4.2366}$						
Oak tree	$V=0.000252*t^{1.7803}$						
Calculation method	N/A						
Comments	N/A						

Data / Parameter	T
Data unit	Year
Description	Time period elapsed between two successive estimations of carbon stock
Source of data	Record time
Description of measurement methods and procedures to be	N/A
Frequency of monitoring/recording	N/A
Value applied:	N/A
Monitoring equipment	N/A
QA/QC procedures to	N/A
Purpose of data	Calculation of project removals $\Delta CTREE_PROJ,t = CTREE,t - C_{tree,0}$
Calculation method	N/A
Comments	N/A

Data / Parameter	N _{it}
Data unit	tree/ha
Description	tree number per ha in category i, at time t

Source of data	The beginning value adopted is from Project Implementation Plan prepared by Local Forestry Bureau. As the project continues, the value will be sampled and calculated at each monitoring.
Value applied:	56 tree/mu for Magnolia 111 tree/mu for Oak tree 100 tree/mu for Mixed tree
Justification of choice of data or description of measurement methods and	The values applied in the estimation are from Project Implementation Plan prepared by Local Forestry Bureau.
Purpose of Data	The parameter is used to calculate biomass of trees within the boundary and then calculate baseline emissions and project emissions. $VTREE_t = A_i \cdot V_{it} \cdot N_{it}$ $BTREE_t = VTREE_t \cdot D_j \cdot BEF_j \cdot (1 + R_j)$ $\Delta CTREE_t = CTREE_t = 44/12 \cdot BTREE_t \cdot CF_j$
Comments	N/A

4.3 MONITORING PLAN

Describe the carbon pools and non-CO₂ GHGs selected for monitoring

As there will be no slash and burn site preparation, overall plough and flood irrigation as well as no machinery tools to be used within the project boundary, hence no significant GHG emissions by sources as results of the proposed project activity.

Table 4-1 Selection of carbon pools

Carbon pool	Selected	Justification
Above ground	Yes	Major carbon subject to the project activity
Below ground	Yes	Major carbon subject to the project activity
Dead wood	No	Conservatively omitted by the applied methodology
Litter	No	Conservatively omitted by the applied methodology
Soil organic carbon	No	Conservatively omitted by the applied methodology

Table 4-2 GHG Emissions by Sources other than Those Resulting from Changes in Carbon Pools

Source	Gas	Included/Excluded	Justification
--------	-----	-------------------	---------------

Combustion of fossil fuels used for vehicles	CO ₂	Excluded	Potential emission is negligibly small.
	CH ₄	Excluded	Potential emission is negligibly small.
	N ₂ O	Excluded	Potential emission is negligibly small.

Determine the sample number

Carbon stocks will be measured according to the stock assessment equations with field sampling based on forest inventory methods. Various sources exist to assist with the design of a verifiable forest field inventory based on best practice for sampling, data management and analysis (Box 3).

In the project area the inventory plan is specified as below:

- a) adequate forest stratification, sample size estimation methods and consider uncertainty:

The forest stratification is based on the species, which is adequate according to the methodology. The sample size estimation methods, allocation among strata and uncertainty consideration is according to the “Calculation of the number of sample plots for measurements within A/R CDM project activities” (version 02.1.0) approved by the CDM Executive Board.

- b) a sampling framework including sample size, plot size, plot shape and information to determine plot location:

The design of a verifiable forest field inventory based on best practice for sampling, data management and analysis are selected from methodology. The sample size estimation methods, allocation among strata and uncertainty consideration is according to the most recent version of the tool for the “Calculation of the number of sample plots for measurements within A/R CDM project activities” (version 02.1.0) approved by the CDM Executive Board.

For the baseline scenario, the calculation process is shown below:

Parameter	Unit	Description
n	dimensionless	Number of sample plots required for estimation of biomass stocks within the project boundary
n_i	dimensionless	Number of sample plots allocated to stratum i for estimation of biomass stocks within the project boundary

The sample plot will be 0.04 ha and at least 3 sample plots will be selected in 1 strata. The total sample plot area is small than 5% of the total project area (27380*5%=1369 ha). So we can conclude that the area sampled will be less than 5% of the project area, which means a small sampling fraction.

Therefore, the following simplified equation can be used for estimating the number of sample plots according to the CDM tool:

$$n = \left(\frac{t_{VAL}}{E} \right)^2 \times \left(\sum_i w_i \times S_i \right)^2$$

where:

- n Number of sample plots required for estimation of biomass stocks within the project boundary; dimensionless
- t_{VAL} Two-sided Student's t -value at infinite degrees of freedom for the required confidence level; dimensionless
- E Acceptable margin of error (i.e. one-half the confidence interval) in estimation of biomass stock within the project boundary; t d.m. (or t d.m. ha⁻¹), i.e. in the units used for S_i
- w_i Relative weight of the area of stratum i (i.e. the area of the stratum i divided by the project area); dimensionless
- S_i Estimated standard deviation of biomass stock in stratum i ; t d.m. (or t d.m. ha⁻¹)
- i 1, 2, 3, ... biomass stock estimation strata within the project boundary

After the estimation of total number of sample plots (n), allocation of number of sample plots among strata is calculated as:

$$n_i = n \times \frac{w_i \times S_i}{\sum_i w_i \times S_i}$$

where:

- n_i Number of sample plots allocated to stratum i ; dimensionless
- n Number of sample plots required for estimation of biomass stocks within the project boundary; dimensionless
- w_i Relative weight of the area of stratum i (i.e. the area of the stratum i divided by the project area); dimensionless
- S_i Estimated standard deviation of biomass stock in stratum i ; t d.m. (or t d.m. ha⁻¹)
- i 1, 2, 3, ... biomass stock estimation strata within the project boundary

Based on the data of biomass stocks in a carbon pool in the baseline scenario, the estimation of number of sample plots required is shown in table 4-3 below:

Table 4-3 Selected Sample Number of Twenty Carbon Layer

Category	Species	Area (mu)	Selected sample number
----------	---------	-----------	------------------------

Proj-1	Magnolia	8496	3
Proj-2	Oak tree	33400	5
Proj-3	Mixed tree	31423	6
Proj-4	Magnolia	7439	3
Proj-5	Oak tree	55628	7
Proj-6	Mixed tree	14263	3
Proj-7	Magnolia	12715	3
Proj-8	Oak tree	45000	6
Proj-9	Mixed tree	9014	3
Proj-10	Magnolia	10584	3
Proj-11	Mixed tree	14514	3
Proj-12	Magnolia	18440	3
Proj-13	Oak tree	26796	3
Proj-14	Mixed tree	22990	3
Proj-15	Magnolia	10000	3
Proj-16	Oak tree	25000	3
Proj-17	Mixed tree	15000	3
Proj-18	Magnolia	10000	3
Proj-19	Oak tree	25000	3
Proj-20	Mixed tree	15000	3
Total		410702	72

Carbon stock changes over time shall be estimated by taking measurements in plots at each monitoring event. Monitoring events shall take place at intervals of 5 years. Including monitoring all the parameters needed. Monitoring reports can use such extrapolated parameter values for the determination of net emissions by sources and removals resulting from the project.

Determine the sample location

The sample is fixed rectangle land with 20m*20m (400m²) each. When a sample on a slope is to be selected, the gradient must be monitored, and the horizontal long should be converted into oblique long. The management methodology (irrigation, fertilization, etc) within the samples must be the same as those outside the samples. If fire breaks out, another sample could be selected near the original sample.

Monitoring frequency

The monitoring of the project implementation will take place every five year after the project registration in order to ensure the continuity of the benefits. Periodic verification and quantitative monitoring of the project will take place every five years.

Measuring carbon stock changes over time

The growth of individual trees on plots will be measured at each monitoring event. Non-tree vegetation such as herbaceous plants, grasses, and shrubs will not be measured and accounted as per methodology applied. The carbon stock changes in living biomass of trees on each plot are then estimated through Biomass Expansion Factors (BEF) method.

Step-wise procedures (BEF method) of the approved baseline and monitoring methodology AR- ACM0003/Version 02.0 will be followed to monitor the verifiable carbon stock changes in the above-ground.

The volume of the commercial component of trees is calculated based on locally derived equation as follows:

Tree Species	The Volume of the Commercial Component of Trees
Magnolia	$V=0.9741*(1-e^{-0.0314t})^{4.2366}$
Oak tree	$V=0.000252*t^{1.7803}$

V: Commercial volume of tree, $m^3 \cdot tree^{-1}$

Put the result coming from the above equation into the formula in Section 3.2, we can get the change in carbon stocks for the proposed project.

Database management

Data management includes electronic version and printed version. All the data copy must be preserved by all the project stakeholders. The preserved documents include:

- The original monitored data, experiment data, results of data analysis and electronic database;
- All the estimated data covering change in carbon stock;
- All the maps including GIS maps;
- Monitoring reports.

Uncertainty

$U_c=8.39\%$

According to the methodology, if $U_c \leq 10\%$ then no deduction will result for uncertainty, as $U_c < 10\%$, then no deduction will result from uncertainty.

5 SAFEGUARDS

5.1 NO NET HARM

There is no potential negative environmental or socio-economic impact due to the project.

5.2 ENVIRONMENTAL IMPACT

An Environmental Impact Assessment (EIA) is not required for logged to protected forest projects according to Construction project classification management of environmental

impact assessment list¹. The key mitigation action of the project activity is avoiding the illegal harvest of the forest, which can protect and improve the surviving environment, keep the ecological balance, save the species resources and enhance homeland security.

The detail impact on the environment is listed below.

Impact on water and soil erosion

Mitigating water and soil erosion is one of the main purposes of the proposed project activity. The project activity will interrupt the surface soil in the project area a little bit during the planting process. The total interrupted area composes of 2.79% of the total area. After the planting activity completes, the vegetation will recover very soon. The project will highly improve the soil and water condition.

Impact on Vegetation

The temperate impact on the vegetation mainly comes from soil preparation before the planting activity. The vegetation impacted by the project activity composes of 2.79% of the total vegetation. After the planting activity completes, the quality and quantity of the vegetation within the project boundary will be highly improved.

Impact on animals

There is no important animal within the project boundary. After the planting activity complete, the ecological environment will be highly improved. As the improved environment, the animal population will developed and biodiversity will be improved.

Impact on water, atmosphere and sound

The project won't have construction with mechanical equipment, noise, construction waste, waste gas, and dust. So the project won't have negative impact on atmosphere and sound. The project activity takes a quite short time, and does not involve many workers. Most of the workers are local, so little living waste will be generated by the project. Thus, there is almost no the negative impact on water.

Climate change mitigation

This is achieved by carbon sequestration, which has been full analysed in the above content. None of the above risk or negative impact is considered to be significant.

5.3 LOCAL STAKEHOLDER CONSULTATION

Questionnaires were distributed by the project proponent to the residents who lives in the community and closely related to the project. The questions aimed to find out their concerns and opinions about the project. The questionnaires covered areas of economic, social benefit and environmental effect etc. The content of the questionnaire includes the following information :

¹ http://www.gov.cn/gongbao/content/2009/content_1265996.htm

1. The purpose of the questionnaire
2. Basic information of the participants
3. Questions
 - 1) Do you know the proposed project?
 - 2) What do you think the proposed project will bring to you?
 - 3) Do you support the implementation of the proposed project?
 - 4) What is your concern about the proposed project?
 - 5) What is your opinion and suggestion regarding the proposed project?

The following is a summary of the key findings based on returned questionnaires.

1. The education background of the participants

The targets of this investigation are the people who will be affected by the project. A part of them finished the middle high school education, the rest of them graduated from college.

2. Attitude towards the proposed project

All of them support the implementation of the project, they think the protection of forest instead of cutting is good the environment, and will benefit the sustainable development.

3. The concern about the proposed project

The participants particularly hoping that the proposed project can improve local environmental situation and increase employment opportunities at the same time.

4. Conclusion

The survey shows that the proposed project is 100% supported by local people. It is because they believe the implementation of the project will bring multiple benefits.

5.4 PUBLIC COMMENTS

N/A