

**Climate Smart Management of Grassland  
Ecosystems Project**

**Environmental Impact Assessment**

**Climate smart management of grassland ecosystems office**

**2019.6**

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# Chapter 1 General Introduction

## 1.1 Project Backgrounds

Grassland is the most widely distributed terrestrial ecosystem on the planet, with an area of about  $3.42 \times 10^9$  hectares, and it covers 25% of the global land area, seals 1/3 of the global terrestrial ecosystem carbon. More than 50% of the world's forage livestock produced from grassland, the livelihood of nearly 600 million people in developing countries rely on grassland. Grassland plays an important role in global carbon and nitrogen regulation, climate change and food security. In the past 30 years, under the double pressures of increasing intensity of human activities and global climate change, the structure of grassland ecosystem is tending to change, energy flow and logistics are accelerating imbalance, and the ecosystem is gradually degenerating. At the same time, due to the increasing emphasis of the international community on climate change, biodiversity conservation and carbon sequestration and mitigation, the research on carbon sequestration and mitigation of grassland ecosystem has attracted unprecedented attention of the scientific community.

The area of grassland in China is nearly 400 million hectares, accounting for about 40% of the country's land area, which has a huge potential carbon sequestration and can absorb about one-third of the greenhouse gas every year and support millions of herders in animal husbandry. The alpine meadow on the Qinghai-Tibet Plateau is one of the main grassland types in China, accounting for 37% of the total grassland area in China. Due to years of over-utilization and cultivation, combined with regional climate warming and drying, more than 80% of the grassland in this area has different degrees of degradation, and grassland productivity, biodiversity, water conservation, wind and sand fixation and soil conservation have significantly decreased, which affects the production and life of local herdsmen, and also threatens the stability of ecological environment in China and even in East Asia. Therefore, it can not only protect grassland biodiversity, improve grass and animal husbandry productivity and grassland soil carbon storage, but also a strategic choice to maintain the sustainable development of grass and animal husbandry in pastoral areas China, with the promotion and application of biodiversity conservation and carbon sequestration technology on the premise of ensuring grass and animal husbandry production

capacity in the main grassland distribution areas of China, and demonstration and effect evaluation.

This project performed in the Qilian County of Qinghai Province on South side of Qilian Mountain on the northeastern margin of Qinghai-Tibet Plateau, which is the main type of grassland in China. For the ecological and production problems faced by the development of regional grass and animal husbandry, the demonstration and application of climate-smart grassland husbandry technology was carried out to protect grassland biodiversity, reduce production emission of grass and animal husbandry, fix carbon in soil and enhance adaptability and productivity of grass and animal husbandry, and explore the ways and techniques of increasing carbon sink in grassland ecosystem under human intervention. It can help the carbon sequestration and mitigation of grassland, reduce grassland degradation, strengthen the climate adaptability of grassland, increase forage production in demonstration areas, improve the livelihood of herders, and benefit grassland protection and sustainable development, through the actual investment of project activities. At the same time, it helps to implement the China Climate Action under the "United Nations Framework Convention on Climate Change" and China's national actions under the "Convention on Biological Diversity"; it will have a forward-looking and leading effect in promoting the development of grass and animal husbandry in China and to serve the implementation of the sustainable development strategy of agriculture in China.

The project is in line with the key areas of GEF's sixth operational plan target of "Biodiversity Conservation" and "Global Climate Change". It will promote the transformation of traditional quantitative animal husbandry to modern quality-benefit grass and animal husbandry production mode through the promotion of modern new technologies such as grassland improvement, seasonal grazing pressure regulation and efficient breeding, and at the same time, promote grassland biodiversity conservation and grassland soil carbon sequestration, and then build climate-smart grassland ecosystem management. The project will be coordinated with the policies of the "Grassland Ecological Protection Subsidy and Reward Mechanism" and the "Project of Returning Grazingland to Grass", which are being implemented by the Chinese government, and closely coordinated with central and local government agencies.

## **1.2 Origin of the evaluation task**

In order to solve the problems of contradiction between grassland protection and

animal husbandry development, lagging development of pastoral areas, degradation of grassland ecosystem and weak infrastructure for ecological construction, draw on international experience better and carry out extensive international cooperation, the Ministry of Agriculture and Rural Affairs of the Chinese Government (MARA, project implementer) and the World Bank (WB, GEF International Implementation Unit) Jointly applied for GEF 6 "China - Global Environment Facility Partnership for Sustainable Agricultural Development - Climate Intelligent Grassland Ecosystem Management Project". The concept text of the project has been approved by the 53rd GEF Council. The PPG phase of the project was officially launched in January 2018 for 18 months. The project plans to establish a demonstration area in Qilian County of Qinghai Province for grassland ecosystem in the middle and upper reaches of Qilian Mountain-Heihe River basin in China. It can provide a basis for the integrated demonstration of grassland animal husbandry, grassland ecosystem technology, policy adjustment, carbon sequestration and emission reduction and efficient production mode. Through technical demonstration and application, policy innovation and popularization of new knowledge, we will promote the revitalization and construction of grassland animal husbandry, grassland ecosystem and pastoral areas in China, enhance the ability of grassland animal husbandry and grassland ecosystem to resist climate change, and provide successful experiences and models for grassland ecosystem management in the world.

To better implement the project, the Climate Intelligent Grassland Ecosystem Management Project carried out the task of "CSG-C-003: Environmental Impact Assessment".

## **1.3 Design Basis**

### **1.3.1 Laws and regulations**

(1) The revised version of the Environmental Protection Law of the People's Republic of China (2015.1.1);

(2) Law of the People's Republic of China on the Prevention and Control of Environmental Noise Pollution (1997.3.1);

(3) The revised version of the Law of the People's Republic of China on Prevention and Control of Atmospheric Pollution (2016.1.1)

- (4) The revised version of the Law of the People's Republic of China on Prevention and Control of Water Pollution (2018.1.1);
- (5) Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Wastes (2005.4.1);
- (6) The Law of the People's Republic of China on Grassland (2003.3.1);
- (7) Chinese People's Republic Animal Husbandry Law (2006.7.1)
- (8) Amendment of the Law of the People's Republic of China on the Protection of Cultural Relics 2017 (2017.11.5);
- (9) Revision of the Regulations of the People's Republic of China on Nature Reserves in 2017 (1994.12.1);
- (10) Regulations of the People's Republic of China on Scenic Spots (2006.12.1)
- (11) Revision of Environmental Impact Assessment Law of the People's Republic of China (2016.9.1);
- (12) Regulations on Environmental Protection Management of Construction Projects (2017.10.1);
- (13) “Technical Specifications for Pollution Control Engineering of Livestock and Poultry Industry” (HJ497-2009);
- (14) Regulations on the Implementation of the Law of the People's Republic of China on Soil and Water Conservation, State Council Order No. 676 (2017.3.1);
- (15) Law of the People's Republic of China on Contracting Rural Land (2010.3.1).

### **1.3.2 Departmental rule**

- Measures on Public Participation in Environmental Protection (2015.9.1);

### **1.3.3 Local regulations**

- (1) “Administrative Measures for Qinghai Qilian Mountain Ecological Protection and Construction Comprehensive Treatment Project” (2018.11.13);
- (2) “Measures for the Transfer of Grassland Contracting Management Rights in Qinghai Province” (2012.3.1);
- (3) “Revision of the Measures for Geological Environment Protection in Qinghai Province” (2009.11.6);
- (4) “Regulations for the Administration of Forest and Wildlife Type Nature

Reserves in Qinghai Province” (1994.12.29);

(5) “Qinghai Provincial Grassland Supervision Regulations” (1996.5.20).

#### **1.3.4 Technology specifications**

(1) HJ2.1-2011 "Technical Guidelines for Environmental Impact Assessment - General Outline", implemented on January 1, 2017.

(2) Huanfa [2012] No. 98 Ministry of Environmental Protection “Notice on Strengthening Risk Prevention and Strict Environmental Impact Assessment Management” ; implemented on July 3, 2012.

#### **1.3.5 Project related documents**

(1) Feasibility study report of “Global Environment Facility (GEF) Project Climate Intelligent Grassland Ecosystem Management”;

(2) 13th Five-Year Plan of Qilian County, Qinghai Province;

(3) Summary report on research and design of “increasing carbon sinks and coping with climate change in grasslands”;

(4) Social Assessment Report of the “Global Environment Facility (GEF) Project Climate Smart Grassland Ecosystem Management” project;

(5) Pest Management Plan of the “Global Environment Facility (GEF) Project Climate Smart Grassland Ecosystem Management” project.

#### **1.3.6 World Bank Policy**

(1) World Bank Business Policy

The environmental assessment and management plan of this project involves two parts of the project activities: natural grassland management and cultivated grassland management. The World Bank business policies involved in this project are shown in table 1-1.

Table 1-1 the World Bank's business policy touches

| World Bank Business Policy |                          | Applicable | This project involves the Bank's business policy impact assessment related description   |
|----------------------------|--------------------------|------------|--|
| OP4.01                     | Environmental Assessment | Yes        | <p>Project implementation is expected to have an overall positive impact on the environment.</p> <p>Considering the type, location, sensitivity and scale of the project activity, the potential negative environmental impact is mainly limited to the construction time, including dust, noise, wastewater, soil erosion, traffic disturbance, fence waste disposal, etc., so the project is classified as Class B.</p> <p>The project has prepared an Environmental Impact Assessment (EIA) and an Environmental and Social Management Plan (ESMP) to respond the expected impact. In addition, an independent Social Impact Assessment Report (SA) has been prepared developed to maximize project effectiveness and minimize potential adverse impacts on local communities.</p> <p>The report was prepared using the World Bank's Environmental, Health and Safety (EHS) guidelines as an important reference and has conducted due diligence on existing facilities and projects related to the proposed project.</p> <p>During the preparation of the EIA, twice public consultation and open information were done in accordance with national requirements and World Bank policies. Survey methods include farmer surveys, symposia, and interviews with key stakeholders.</p> |
| OP4.04                     | Natural habitat          | Yes        | <p>The project activities: the fences reinforcement, the no-tillage reseeded of degraded grassland, the manual planting grass, the rodent and pests control, and the pasture supply in forbidden grazing have potential impact on the biodiversity of grassland and the invasion of alien species. It may have a potential impact on the local grassland ecological environment, therefore it touches on this policy. However, according to the EIA survey, important and sensitive natural habitats are not involved in the project, and there will be no major change or degradation of natural habitats. The potential impact of the activities on the local ecology was analogical analysed in the environmental impact assessment. The mitigation measures were proposed and the necessary mitigation measures were also</p>  |

|         |                                 |     |   |
|---------|---------------------------------|-----|---|
|         |                                 |     | considered in the environmental and social management plan.   |
| OP4.36  | Forestry policy                 | No  | The information shows that the proposed project does not involve forest areas, therefore does not touch this policy.  |
| OP4.09  | Pest management                 | Yes | The project involves the management of pest control, including physical control and pesticide control, therefore involves this policy. The pesticides toxicity is analysed, and prepared the PMP.   |
| OP4.11  | Material cultural resources     | No  | During the investigation and consultation with local government, to choose the project activities in Moeller Town will be only to repair the original damaged fence, no new construction; no-till seeding is only at the degraded grassland; manual planting grass is at their own nests; no material cultural resources were found, therefore, does not touch this policy. |
| OP4.10  | Indigenous people               | Yes | In the project area, there are 6 ethnic groups, including nationalities of Mongolian, Tibet, Tu, Han, Hui and Baoan. Among them, ethnic minorities account for 96% of the total population. Therefore, this policy is involved. A minority development plan has been prepared.  |
| OP4.12  | Involuntary migration           | No  | According to the project feasibility study report, the project does not involve new construction/expansion projects, therefore, does not touch this policy.   |
| OP4.37  | Dam safety                      | No  | The project does not involve the construction of dams. The nearest reservoir to the project area is: Nazixia Hydropower Station, the reservoir of the hydropower station is in Zhasha Village, and the dam is at the Menyuan. The distance from Moeller Town is 66 km, therefore, does not touch this policy.   |
| OP7.50  | International waters project    | No  | The proposed project site will be in China and does not involve international waters.   |
| OP7.60  | Projects in disputed areas      | No  | The project sites are all located in Qilian County, Qinghai Province, there is no disputed area.  |
| BP17.50 | Open the evaluation information | Yes | At least 2 rounds of information open and public consultation work in this EIA.   |

## (2) Environmental Health and Safety Guidelines

According to the characteristics and property of the project, the EIA will compare and analyze the national environmental quality, pollutant discharge standards and the pollutant control standards requirement by the World Bank Group “General

Environment Health and Safety Guidelines” to be used as the strict basis for monitoring and evaluation.

World Bank Group “General Environmental Health and Safety Guidelines”

World Bank Group “Mammalian Livestock Breeding EHS Guidelines”

World Bank Group “Annual Agricultural Products EHS Guidelines”

#### **1.4 Distinguish the project environmental and social impact**

The project area will select 27 natural villages and 6 administrative villages in Moeller Town, Qilian County, Qinghai Province. This EIA combed the all project contents, distinguished potential environmental and social impacts, and will use the security tools accordance with World Bank policies. The details showed in table 1-2.

Table 1-2 distinguished the project environmental and social impact factors

| Serial | Project name  |   | Content and scale  | WB funds / Matching funds | Potential environmental and social impact   | Security tool     |
|--------|---|---|--|---------------------------|---|-------------------|
| 1      | The innovation and application of grassland management technology |   |  | (US\$10,000)              |   |                   |
| 1.1    | Natural grassland management                                      | No-tillage seeding at degraded grassland    | No-tillage seeding 8000 mu. In the 6 administrative villages of town, 2 or 3 natural villages will be randomly selected from each administrative village; 3 mutual-aid groups will be selected from each project village, 4 households will be selected from each mutual-aid group as project households. 160 households will implement. | 22.5/60                   | <p><b>During Construction time:</b> the dust influence of fence repair and no-tillage seeding; the noise influence of fence repair and no-tillage seeding machinery; the solid waste from fence repair may have a negative impact on the normal life of local people.</p> <p><b>During Operating time:</b> It needs 15 days forbidden grazing after pesticides to control pest in the project area, and more than a week forbidden grazing after rodenticides. No-tillage seeding and Spring-forbidden grazing may impact the grassland biodiversity.</p> | EIA<br>EMP (ECOP) |
|        |   | Spring-forbidden grazing                    | A total of 48,000 mu, 300 mu per household, forbidden grazing for 60 days. 160 households will implement, and provide the funds for forbidden grazing to households every year.  | 40/290                    |   | EMP               |
|        |   | Fence repair                                | Fence repair in forbidden grazing areas will implement 160000 mu per year, a total of 800,000 mu.  | 0/200                     |   | ECOP              |
|        |   | Rodents and pests control                   | Moeller Town will implement 1 million mu for rodents and pest control per year, and a total of 5 million mu.   | 0/150                     |   | EMP<br>PMP        |
| 1.2    | Cultivated grassland management                                   | Manual planting grass                       | Manual planting grass, project households will be 160, planted once a year, each household 3-4 mu, and a total of 2500 mu.   | 10/60                     | <p><b>During Construction time:</b> The activity will destroy the existing vegetation and disturb the soil layer.</p> <p><b>During Operating time:</b> Manual planting grass will affect small-scale biodiversity.</p>  | EIA<br>EMP (ECOP) |
| 1.3    | Livestock nutrition regulation management                         | Tibetan sheep, yak high-efficiency breeding | There are 160 households in the project, and the project households are given feeding instructions every year. Subsidies for technical   | 5/200                     | <p><b>During Operating time:</b> the impact of livestock manure on the environment, the impact of livestock epidemic prevention on the environment and people.</p>  | EIA<br>EMP        |

| Serial | Project name  | Content and scale  | WB funds / Matching funds   | Potential environmental and social impact | Security tool |
|--------|---|--|---|---|---------------|
| 1      | The innovation and application of grassland management technology |  | (US\$10,000)  |   |               |
|        |   | technology key technology promotion subsidy  | extension personnel at county and township levels.<br>There are 160 households in the project, and the project households are given feeding instructions every year. Subsidize key production materials needed to promote technology. | 10/200                                    |               |
| 1.4    | Technical training and services                                   | Technical consultation and guidance in the project area  | Technical guidance and consultation of relevant industry experts and consultants.   | 60/0                                      | EMP           |
|        |   | Construction of village-level agricultural technology extension platform   | Improve the classroom facilities, staff training, pay a certain cost of training technicians, purchase training materials, publicity materials and so on.   | 9/100                                     | EMP           |
|        |   | Technical training for agricultural and livestock technology and management personnel in the three levels of county and village. | Technical training for agricultural and livestock technology and management personnel in the three levels of county and village.  | 8/0                                       | EMP           |
|        |   | Pastoralist teaching   | Supporting grassland field survey and grassland patrol control. Organize grassland, animal husbandry, and veterinary related professional and technical personnel   | 15/260                                    | EMP           |

**During Operating time:** The project implementation will need the support of science, technology and information to finish the activities with the requirements of the objectives.

| Serial | Project name  | Content and scale   | WB funds / Matching funds   | Potential environmental and social impact | Security tool  |         |     |
|--------|---|---|---|---|--|---------|-----|
| 1      | The innovation and application of grassland management technology |   | (US\$10,000)  |   |  |         |     |
|        |   |   | to carry out technical guidance work for Moeller Town.  |   |  |         |     |
| 1.5    | Monitoring and evaluation   | Grassland productivity monitoring and evaluation            | Monitoring and evaluation of above-ground and underground biomass, grass cover, grass layer height and cultivated grassland yield of natural grassland/main species in the project area, and constructing a dynamic model of grassland productivity in the early, middle and late stages of project implementation. | 20/50                                     | During Operating time: The environmental, social impacts, mitigation measures of the project activities, and the project objectives will be assessed the results through the monitoring. | EMP     |     |
|        |   | Grassland biodiversity monitoring and evaluation            | Monitoring and evaluating the species composition and community structure of grassland vegetation in the project area, and calculating grassland biodiversity, and carrying out the steps in the early, middle and late stages of project implementation.   |   |  | 20/50   | EMP |
|        |   | Monitoring and evaluation of grassland carbon sequestration | Evaluate and measure soil carbon sequestration and livestock greenhouse gas emission reduction in the project area. Calculate soil organic carbon and organic carbon storage model to calculate soil carbon sequestration.  |   |  | 20/50   | EMP |
|        |   | Social impact monitoring and evaluation                     | Monitoring the implementation of security policy in the project area and evaluation of production and income.   |   |  | 12.5/30 | EMP |
|        |   | Environmental benefit monitoring and                        | Monitoring and evaluation of environmental effectiveness in project area, including surface water   |   |  | 12.5/30 | EMP |

| Serial | Project name  | Content and scale | WB funds /<br>Matching funds  | Potential environmental and social impact | Security tool |
|--------|---|-------------------|---|---|---------------|
| 1      | The innovation and application of grassland management technology |                   | (US\$10,000)  |   |               |
|        |   | evaluation        | quality, pest management, and monitoring and evaluation of pesticide application effects. |   |               |
| 2, 3   |   |                   |   |   |               |

The distribution of the project area is shown in Fig.1-1.

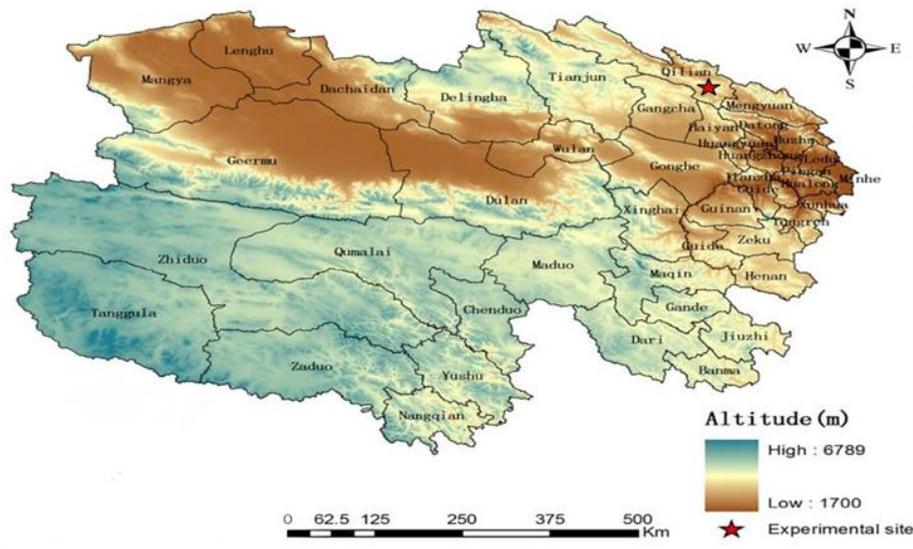


Fig.1-1 Schematic diagram of Qilian project area

## 1.5 Evaluation criteria

### 1.5.1 Environmental quality standard

Air environment: Implement the secondary standard of “Environmental Air Quality Standards” (GB3095-2012).

Surface water: Implement the Class II and Class III of “Environmental Quality Standards for Surface Water” (GB3838-2002).

Groundwater: Implement the Class III of “Groundwater Quality Standard” (GB/T14848-2017).

Acoustic environment: Implement the Class I of "Acoustic Environmental Quality Standards" (GB3096-2008). Implement Classes 4a , 4b both sides of the main traffic line, Implement Class II for the villages with traffic main traffic line.

The implementation standard values are shown in table 1-3.

Table 1-3 Environmental quality standards

| Environmental element     | Items                               | Value time       | Secondary | Unit              | Standard sources  |          |
|---------------------------|-------------------------------------|------------------|-----------|-------------------|---|----------|
| Atmospheric Environment   | SO <sub>2</sub>                     | Annually average | 0.06      | mg/m <sup>3</sup> | "Environmental Air Quality Standards" (GB3095-2012)           |          |
|                           |                                     | 24-hour average  | 0.15      |                   |   |          |
|                           |                                     | 1-hour average   | 0.50      |                   |   |          |
|                           | PM <sub>10</sub>                    | Annually average | 0.07      |                   |   |          |
|                           |                                     | 24-hour average  | 0.15      |                   |   |          |
|                           | NO <sub>2</sub>                     | Annually average | 0.04      |                   |   |          |
|                           |                                     | 24-hour average  | 0.08      |                   |   |          |
|                           |                                     | 1-hour average   | 0.20      |                   |   |          |
|                           | TSP                                 | Annually average | 0.2       |                   |   |          |
| 24-hour average           |                                     | 0.3              |           |                   |   |          |
| Surface water environment | Items                               | Class II         | Class III | --                | "Surface Water Environmental Quality Standards" (GB3838-2002) |          |
|                           | pH                                  | 6~9              |           | --                |   |          |
|                           | DO                                  | ≥6.0             | ≥5.0      | mg/L              |   |          |
|                           | Ammonia                             | ≤0.5             | ≤1.0      |                   |   |          |
|                           | TP                                  | ≤0.1             | ≤0.2      |                   |   |          |
|                           | COD <sub>Mn</sub>                   | ≤4.0             | ≤6        |                   |   |          |
|                           | COD <sub>Cr</sub>                   | ≤15              | ≤20       |                   |   |          |
|                           | BOD <sub>5</sub>                    | ≤3.0             | ≤4        |                   |   |          |
| Groundwater environment   | Items                               |                  | Class III | Unit              | "Ground Water Quality Standard" (GB/T14848-2017)              |          |
|                           | pH (Dimensionless)                  |                  | 6.5-8.5   | --                |   |          |
|                           | Ammonia                             |                  | 0.5       | mg/L              |   |          |
|                           | Total hardness (CaCO <sub>3</sub> ) |                  | 450       |                   |   |          |
|                           | Nitrate (N)                         |                  | 20        |                   |   |          |
|                           | Nitrite (N)                         |                  | 1.0       |                   |   |          |
|                           | Volatile phenols                    |                  | 0.002     |                   |   |          |
|                           | Total solubility solid              |                  | 1000      |                   |   |          |
|                           | COD <sub>Mn</sub> (O <sub>2</sub> ) |                  | 3.0       |                   |   |          |
|                           | Total coliform (Number /L)          |                  | 3         |                   |   |          |
| Acoustic environment      | Items                               | Class I          | Class II  |                   | Class 4a  | Class 4b |
|                           | Daytime                             | 55               | 60        | 70                | 70  |          |
|                           | Nighttime                           | 45               | 50        | 55                | 60 (55)   |          |

### 1.5.2 Pollutant discharge standard

Waste gas: Executive standard “Integrated emission standards for atmospheric pollutants” (GB16297-1996) unorganized emission monitoring concentration limit.

Noise: Executive standard “Construction site boundary noise limit” (GB12523-2011). The standard values for implementation are shown in table 1-4.

Table 1-4 Pollutant discharge standard

| Category  | Items           | Unorganized emission monitoring concentration limit | Unit              | Standard sources  |
|-----------|-----------------|---|-------------------|---|
| Waste gas | particulates    | 1.0   | mg/m <sup>3</sup> | “Integrated emission standards for atmospheric pollutants” (GB16297-1996) |
|           | NO <sub>x</sub> | 0.12  | mg/m <sup>3</sup> |   |
|           | SO <sub>2</sub> | 0.40  | mg/m <sup>3</sup> |   |
| Noise     | Daytime         | 70  | dB (A)            | “Construction site boundary noise limit” (GB 12523-2011)                  |
|           | Nighttime       | 55  | dB (A)            |   |

### 1.6 Compliance analysis of project and regional related policies and plans

The project is based on the demonstration and promotion of new technologies in the whole chain of grassland improvement - grassland plant production and diversity protection - herbivorous livestock production in grassland ecosystem, to improve grassland productivity and grass and animal husbandry production efficiency and increase the income of farmers and herders; at the same time, to protect grassland biodiversity. To improve ecological service functions such as carbon sequestration and mitigation in grassland, realize the coordinated development of the human-grass-livestock system.

The target of the 13<sup>th</sup> Five-Year Plan of Qilian County are: “to strengthen grassland industry, transition and upgrade, integration three industries, innovation actuation, industry linkage, all-round development, to build characteristic agriculture and animal husbandry in Qilian County”. The planning related to the project is “Qilian grassland ecological protection and grassland industry system construction”.

According to the requirement of “accelerating development grassland husbandry” in document No.1 in 2015, will focus on “grassland industry, grassland industry first, grassland-livestock linkage, grassland-livestock balance”, to establish resource recycling for grass and animal husbandry industry system. The contents include: (1) Natural grassland improvement and efficient utilization. During the 13<sup>th</sup> Five-Year Plan, under the guidance of "**artificial intervention, increasing production**", the plan is to finish 600,000 mu the task of Black Soil Beach Control; 1.655 million mu **medium and light no-tillage seeding and fertilization grassland**. (2) **The construction of artificial feeding grassland**. Use “the complementarity with farming and animal husbandry”, five towns introduce the high-production, high-quality forage varieties to form a new pattern of “farming plant and animal husbandry buying” and “animal husbandry self-sufficiency”. (3) Grassland ecological restoration. Implement the second round of the national policy of the grassland ecological protection awarding policy, and strictly implement **forbidding grazing, fencing and grass and animal balance**. (4) Animal husbandry and farming mode. (5) Construction of grass service team. (6) Establishing a good grassland processing and distribution system. **Improve the level of forage production and supply services**. (7) **Promotion and demonstration grazing system**.

This project is highly consistent with the 13<sup>th</sup> Five-Year Plan of Qilian County in the project area, and the project implementation can help to realize the planning objectives.

# **Chapter2 Environmental Status of the Project Area**

## **2.1 Overview of Natural Environment**

### **2.1.1 Geographical Location**

Qilian County is located in the northeastern part of Qinghai Province and the northwestern part of Haibei Prefecture. It is 100°12' east longitude and 38°05' north latitude. It is known as the "North Gate" of Qinghai cause of it is the Gansu Hexi Corridor which is the primary channel of Ancient Silk Road. The county covers an area of 14,000 km<sup>2</sup>, accounting for 41% of the total land area in Haibei Tibetan Autonomous Prefecture.

The project area Moeller Town is located in the southeast of Qilian County, Qinghai Province. The total land area of the Town is 5.7402 million mu, accounting for 24.3% of the county's total area. The geographical range is N 37°59'17"~37°57'35", E 100°13'20"~100°11'25". It is located in the hinterland of the middle section of Qilian Mountain, with an altitude of 3550~3700 m.

### **2.1.2 Landform**

Qilian Mountain is a typical Caledonian geosyncline fold system in the Kunlun Qinling, and the folds are returned to the front of the continental Devonian millstone. The North Qilian Mountains and the Hexi Corridor see that the Middle and Lower Devonians are not integrated into the Lower Paleozoic (such as Wuwei Killu Temple) and the Late Caledonian granite (such as Jiulingling South Ma Liangou, etc.). The Ladun Mountains see the middle and lower Devonian are not integrated on the Middle and Upper Ordovician. The Upper Devonian in the South Qilian Mountains

Wulan Daban is not integrated with the Lower Silurian. It represents that Qilian Mountain is mainly formed in the late Caledonian folds. It basically changed from the trough to the platform development stage, so the Late Paleozoic, the Middle and the Cenozoic Deposited for the cover of the platform. Qilian County has a variety of geographical features such as grasslands, snow mountains, forests, canyons, glaciers, etc., which constitute a unique original ecological landscape.

### **2.1.3 Groundwater and Surface Water**

There are two major river watersheds in Qilian, namely the Moeller River in the Datong River system and the Heihe River in the inland water system of Qilian Mountain. There are 247 large and small branches with the 13,100 km<sup>2</sup> catchment area. The annual runoff water is 2.3 billion m<sup>3</sup>, including 93 rivers with an average annual flow of 0.1 m<sup>3</sup>/s. The water resources are abundant; the theoretical reserves of water energy are 567,700 KW. Among them, more than 100,000 KW of water can be developed and utilized.

In the Tolle Valley, groundwater is leaked from Mountain Rivers. The depth of groundwater in the Moller area is between 10 and 50 m, and the thickness of the aquifer is between 10 and 30 m.

### **2.1.4 Climate**

The project area of Moeller town is the plateau continental climate, where the cold season is long, the warm season is short. The average annual temperature is 1.4°C. The difference of daily temperature is large, the dry and wet seasons are obviously clear. The temperature and precipitation vertical change is obvious. The rainy season coincides with the hot season. The annual average precipitation is 415.0mm and has no absolute frost-free period. There are abundant of solar energy resources, there is the annual sunshine hour of 2829h solar radiation intensity and is more than 0°C accumulated temperature 1658.0°C. The average annual evaporation is 1162.3mm.

## **2.2 Overview of Social Economy**

Moeller town was established by the merger of Moeller and Duolong townships in March 2002, with 37 administrative and career staff, including 18 administrative staff, 8 career staff and 24 public welfare job position and Internship position.

Moeller has 6 herdsmen's committees and 27 animal husbandry cooperatives. The town has 13 administrative units and 3 temples (including 2 Tibetan temples and 1 mosque). There are a total of 2,153 households of 7,182 people in the town, which have 6 ethnic groups including nationalities of Mongolian, Tibetan, Tu, Han, Hui and Baoan, among which ethnic minorities account for 96% of the total population. There are 7 Party branches and 289 Party members. The number of participating in the cooperative organization of party members is 172. The number of these Party members under the age of 35 is 74, accounting for 25.4% of the total number of Party members. The number of the age from 36 to 45 is 87, accounting for 31%, the number of the age from 46 to 54 is 58 of Party members, accounting for 20.4%, the number of the age from 55 to 59 is 21, accounting for 7.1%, the number of the age over the age of 60 is 45, accounting for 15.8%. There are 272 ethnic minority Party members, accounting for 94%, which has 48 female Party members, accounting for 16.5 % of the total number of Party members. There are 38 Party members with a college education or above, accounting for 13% of the total number of Party members; there are 5 Party members with high school education, accounting for 0.2% of the total number of Party members. There are 16 Party members with junior high school education, accounting for 0.6% of the total number of Party members. There are 230 party members with primary school education, accounting for 80% of the total number of Party members. Every village has 6 Party branch secretaries and 6 village committee directors. The net income of herdsmen reached 15,889.8 yuan Average per person in 2015.

In 2018, the county has made great efforts to promote green development and highlight transformation and adjustment. Green industry has become the centre of economic efficiency reform in the county. The economic development has been constant. The sustainability of development has been continuously enhanced. The

300,000 ton Xinchuan Mining Co. LTD. runs smoothly. The deli processing project of the Yida Company goes into production. The Jinqilian Dairy co., LTD. has been incorporated into industrial enterprises, also as the Jiyuan Tourism Development Company and Minmetals (Qilian) Development Company. Three e-commerce enterprises have been cultivated, with an online trading volume of 211 million yuan and an online retail sales volume of 75.46 million yuan. During the "Qing consultation" period, there were 8 contracted projects; the Signature rate was 100%.

In 2019, Qilian County's total industrial output value was 43.717 million yuan in the first quarter, with a year-on-year growth of 80.2%. The industrial output value was 30.999 million yuan in the first quarter, with a year-on-year growth of 192.3 %. Both achieved substantial growth and made a good start in industrial economic development, got the hard foundation to achieve the economic development targets for this year.

## **2.3 Overview of Ecological Environment**

### **2.3.1 Soil**

The soil is mainly alpine meadow in the project area.

### **2.3.2 Land Use and Animal Husbandry**

The total land area of the town is 5.7402 million mu, accounting for 24.3% of the county's area. There are 3.9469 million mu of natural grassland, accounting for 22.4% of the county's grassland area. The available grassland was 3.7386 million mu with the utilization rate is 88.67%.

Moeller town is located in the southeast of Qilian county, there are 3.9469 million mu of grassland (3.4985 million mu is an available grassland, with the utilization rate of 88.67%), which belongs to Mountain meadow grassland, is natural good pasture. There are 330,600 livestock (214,700 sheep, 94,000 yaks). The total number of livestock accounted for 28.1% of the county's livestock. Moeller Town is

the county's largest animal husbandry township, is the county's white Tibetan sheep breeding base. It is famous for white Tibetan sheep breeding sheep, mutton and white hair. The livestock of traditional grassland animal husbandry had strong adaptability and tolerance to crude feeding, but its growth rate was slow and the production was low. But the improved breed livestock has the advantages of good quality, fast weight gain, short feeding period, high forage conversion rate, excellent animal product quality and high industrial value. The town introduced 50 wild blood yak breeds of bulls and completed the breeding ram across the country for 2680 sheeps.

### **2.3.3 Animal Husbandry Infrastructure**

Animal husbandry infrastructure has been improving year by year. The town has built 1,075 warm sheds with 116,100 m<sup>2</sup> for sheep and cattle fencing. It realized 1.243 million mu of grassland fencing and 7,536.5 mu of manual planting grass and 364,000 mu of rotational grazing. Moeller town uses the advantage of the seasonal rule of grassland animal husbandry and full use the established warm shed and artificial pasture for cattle and sheep fattening. Instead of relying on natural pasture for year-round grazing, Moeller town turns to summer and autumn grazing, winter and spring sheltering and semi-sheltering.

### **2.3.4 Ecological Environment**

The forestland area of Qilian is 3.1457 million mu with the forest coverage rate is 13.5%, which is 8.3 % higher than the average level of the whole province. It is the main water conservation forest in the middle of Qilian Mountain, mainly including Qinghai Spruce, Qilian Cypress and the special species of Qilian Poplar. There are as many as 368 species economic medicinal plants, such as Rhubarb, Bupleurum, Saussurea, Chinese caterpillar fungus and so on. There are more than 20 kinds of wild animals, such as wild yak, wild donkey, white-lipped deer, snow leopard and bear.

There are a total of 17.64 million mu of grassland and 1.6 million head of livestock with existing forest area of 3.14 million mu and the forest coverage rate of 13.5% in Qilian county. It is an important water conservation forest in the middle of Qilian Mountains. At present, the area of soil erosion and rodent damage has 4600 km<sup>2</sup>. The overgrazing area is 10.9 million mu. The grass production of grassland has decreased from 325kg/mu to 101kg/ mu. Desertification area continues to expand and the current total area of desertification is 1.09 million mu. There are serious natural disasters with high frequency of high winds, drought, floods, hail, snowstorms and other disasters.

There are 3.9469 million mu of grassland (3.4985 million mu of available grassland, with the utilization rate of 88.67%) in Moeller town.

The grassland distribution in the project area of Moeller town is shown in figure 2-1.

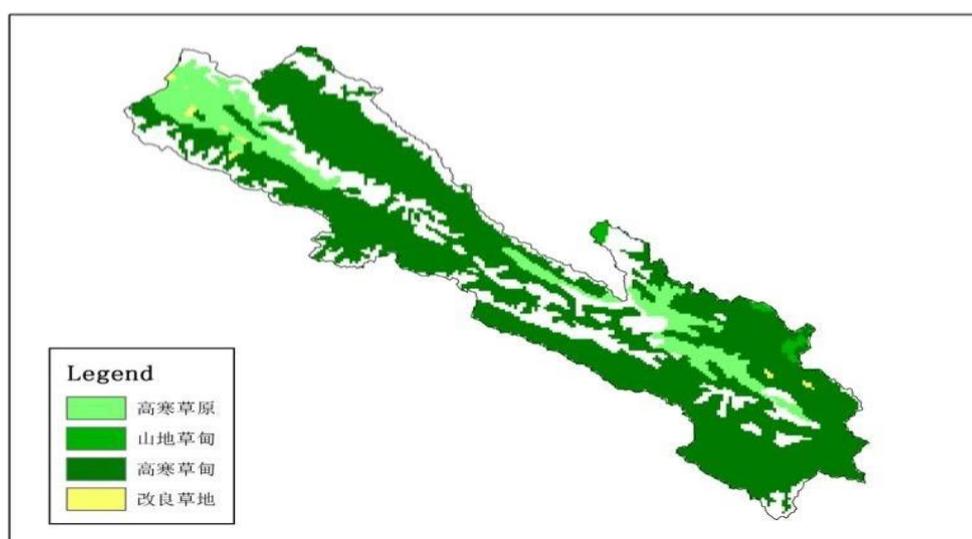


Figure 2-1 grassland distribution in project area, Moelle town, Qilian

The nature reserve associated with the project area is the Qilian Mountain National Park. Located at the border of Gansu and Qinghai provinces, the Qilian Mountain National Park covers an area of 50,200 km<sup>2</sup>. Qinghai covers an area of 15,800 km<sup>2</sup>, accounting for 31.5% of the total area of national parks. Divided by administrative divisions, Qinghai province includes Haibei Tibetan autonomous prefecture Menyuan county, Qilian county, Haixi prefecture Tianjun county and

Delingha city, with a total of 41,000 people in 60 villages, 17 towns and villages.

The Qilian Mountain National Park in Qinghai province include a provincial nature reserve, a national forest park and a national wetland park. The centra area of the Qilian Mountain provincial nature reserve is 365,500 hm<sup>2</sup>, the buffer area is 175,100 hm<sup>2</sup>, and the experimental area is 261,700 hm<sup>2</sup>.

The location of The Qilian Mountain National Park is shown in figure 2-2.



Figure 2-2 scope map of The Qilian Mountain National Park

## 2.4 Environmental Quality Status

### 2.4.1 Air Environmental Quality Status

According to the historical data of Zhenqi.com, the average air quality of Haibei Prefecture in 2018 matched the secondary standard in Air Quality Standard (GB3095-1996). Haibei Prefecture in 349 days before December 15 2018, there are 96 days excellent air quality, 227 days good level, 14 days light pollution, and 2

days severe pollution. The number of days above good level was 92.6%. The annual average concentrations of PM<sub>10</sub> was 0.044mg/m<sup>3</sup>, SO<sub>2</sub> 0.015mg/m<sup>3</sup>, NO<sub>2</sub> 0.015mg/m<sup>3</sup>, respectively. The primary pollutant is PM<sub>10</sub>; no acid rain in all year.

#### **2.4.2 Surface Water Environmental Quality Status**

Qilian is known as the “Three Rivers Source” which is the birthplace of Heihe, Datong River and Tuile River. Among them, Heihe belongs to the inland water system. Datong River belongs to the Yellow River watershed. The rivers are distributed monthly, it is mainly based on ice-eliminating from April to June, and it is mainly supplied by precipitation from July to September.

According to the Qinghai Provincial Environmental Quality Report in 2017, the water quality of the four monitoring sections of Datong River matched the Class II standard of Surface Water Environmental Quality Standard GB3838-2002. The water quality of the Heihe Huangzang Temple section matched the Class II standard of the Surface Water Environmental Quality Standard GB3838-2002.

In 2017, the drinking water sources in Qinghai Province matched the Class III standard of Surface Water Environmental Quality Standard GB3838-2002, and the water quality was good.

#### **2.4.3 Groundwater Environmental Quality Status**

According to the 2017 public data of Qinghai Environmental Protection Website, the water quality of the groundwater source in Babao Town has matched Class III standard in the “Groundwater Quality Standards” (GB/T14848-1993), and the water quality matched the standard.

#### **2.4.4 Acoustic Environmental Quality Status**

In 2017, there were 224 noise environmental monitoring points in Xining, the average equivalent sound level was 53.8dB(A), which was lower than the standard value of Class 2 (60 dB) in the Acoustic Environmental Quality Standard

(GB3096-2008). The regional environmental quality level is good.

## **2.4.5 Biodiversity Status of Moeller Town, Qilian County**

### **2.4.5.1 Grassland Coverage**

In order to know the overall vegetation status of the project area, to provide a baseline for grassland recovery evaluation of the project implementation, this environmental impact assessment used 2018 Remote Sensing image (Modis) to estimate the grassland coverage of Moeller Town, Qilian County.

Grass coverage is calculated based on the following formula:

$$FC = \frac{NDVI - NDVI_{min}}{NDVI_{max} - NDVI_{min}}$$

FC is the grass coverage,  $NDVI_{min}$  and  $NDVI_{max}$  are the minimum and maximum NDVI values in the region. Due to the inevitable noise,  $NDVI_{min}$  and  $NDVI_{max}$  take the minimum and maximum values within a certain confidence interval (5%-95%).

The NDVI data used for monitoring was the US Geological Survey (USGS) MODIS-NDVI 16-day synthetic product (MOD13A1) with a spatial resolution of  $500m \times 500m$ . The data collection was from October to September in the 2018 vegetation growing season, with a total of 10 images. Using ArcGIS software, a series of processing such as geometric correction, projection conversion, image splicing and maximum synthesis (MVC) were performed on the downloaded MODIS data to obtain the maximum NDVI synthetic image of the grassland in the study area in 2018.

Grassland coverage is an important indicator reflecting the growth of grassland, and it is also an important parameter to characterize the grassland ecosystem grassland growth and grassland community growth dynamics. It has an important and direct indication of the ecological environment of the grassland. When the grass coverage is reduced or lost, the soil will be directly exposed to the air, which will easily lead to erosion of the soil and cause degradation of the entire ecosystem. Therefore, grassland coverage is often used as an important ecological indicator in

grassland resource monitoring and health assessment studies at regional scales. The analysis shows that the grassland coverage of Moeller Town is shown in Figure 2-3.

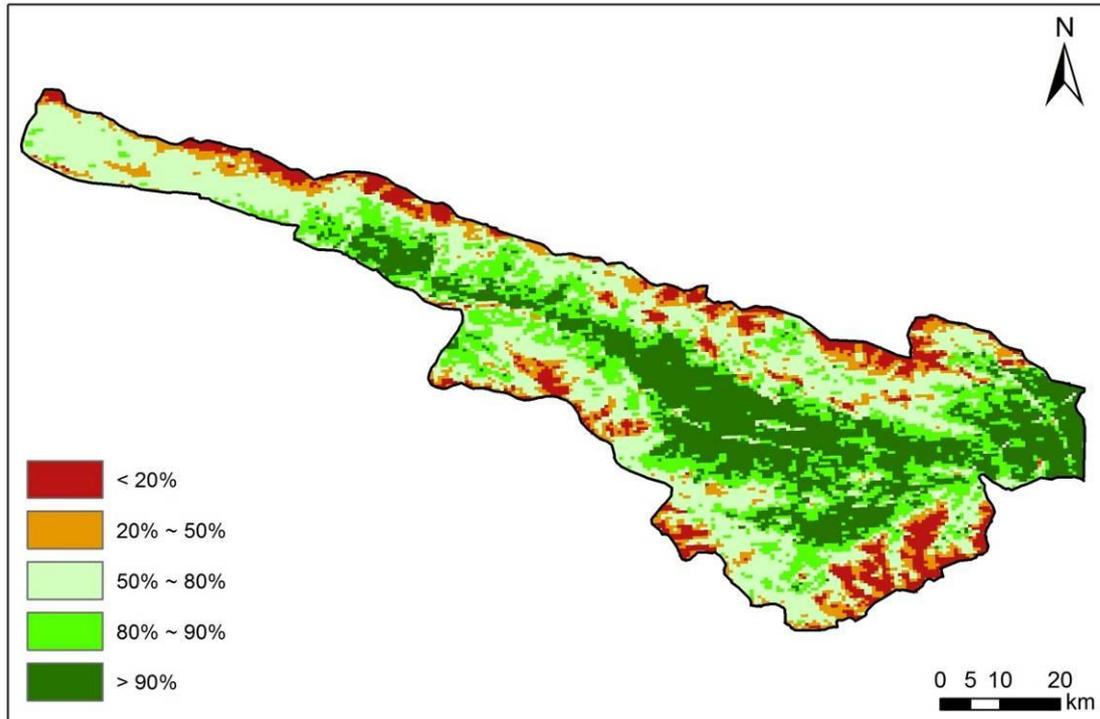


Figure 2-3 Distribution of Grassland Coverage in Moeller Town

It is calculated that the grass coverage of the town of Moeller Town is 69.30%. Among them, the grassland coverage in the eastern and central parts of Moeller Town is high, and the grassland coverage rate at the border of Moeller Town is low.

#### 2.4.5.2 Grassland biodiversity

The habitat of Qilian Mountain is fragile. Due to the global warming and the snow line rising, the water conservation and supply capacity of grassland in Qilian Mountain are reduced, which leads to the decrease of plant biodiversity. In recent years, with the increase of deforestation and mineral exploitation, the ecological environment was destroying. At the same time, due to the influence of overgrazing and rampant rodent damage, the grassland in the area has been seriously degraded. The grassland degradation has led to the decline of the height and coverage of herbage in the community and the decrease of edible herbage. Compared with the 1980s, the production of herbage decreased 50% ~ 70%. The stocking capacity of

grassland decreased, which seriously restricted the development of animal husbandry in the area.

In alpine meadow is the most widely distributed grassland type in Qilian. There are many kinds of plants that form this kind of grassland. The alpine meadow main plant species include *Elymus nutan*, *Poa pratensis*, *Poa crymophila*, *Kobresia pygmaea*, *Kobresia humilis* and so on. The common species in steppe meadow include *Festuca rubra*, *Oxytropis ochrocephala*, *Leontopodium nanum* and so on. The common species in swampy meadows include *Carex moorcroftii*, *Koeleria cristata*, *Scirpus distugmaticus* and so on. Manual planting grassland includes *Elymus nutans*, *Poa pratensis*, *Pedicularis kansuensis*, *Ajania tenuifolia* and so on.

Plant species composition and important values of alpine meadow grassland in Moeller town of the project area are shown in table 2-1. The community diversity index of alpine meadow is shown in table 2-2. The fresh grass production, height and coverage of edible herbage of natural grassland in Qilian County from 2014 to 2018 are shown in table 2-3.

Table 2-1 Plant species composition and important values of alpine meadow grassland

| Species                       | Important Values |
|-------------------------------|------------------|
| <i>Elymus nutans</i>          | 18.47            |
| <i>Poa crymophila</i>         | 14.58            |
| <i>Kobresia pygmaea</i>       | 13.97            |
| <i>Kobresia humilis</i>       | 12.98            |
| <i>Oxytropis ochrocephala</i> | 8.86             |
| <i>Leontopodium nanum</i>     | 3.89             |
| <i>Potentilla nivea</i>       | 4.98             |
| <i>Pedicularis kansuensis</i> | 2.94             |
| <i>Thalictrum alpinum</i>     | 2.09             |
| <i>Plantago asiatica</i>      | 2.79             |
| <i>Gentianella azurea</i>     | 1.54             |
| <i>Saussurea pulchra</i>      | 3.96             |
| <i>Gentiana szechenyii</i>    | 1.26             |
| <i>Cirsium souliei</i>        | 0.28             |
| <i>Taraxacum platyepidum</i>  | 1.84             |
| <i>Ranunculus tanguticus</i>  | 0.73             |
| <i>Lagotis brachystachya</i>  | -                |
| <i>Astragalus fenzelianus</i> | -                |
| <i>Ajuga lupulina</i>         | 1.78             |
| <i>Potentilla multifida</i>   | 1.48             |

Table 2-2 the community diversity index of alpine meadow

| Grassland types | Species richness | Shannon-Wiener index | Evenness index | Simpson's diversity index |
|-----------------|------------------|----------------------|----------------|---------------------------|
| Alpine meadow   | 20.25            | 2.519                | 0.817          | 0.894                     |

Table 2-3 the fresh grass yield, height and coverage of edible herbage of natural grassland in Qilian County from 2014 to 2018

| Year                                    | 2014    | 2015    | 2016    | 2017    | 2018    |
|---|---------|---------|---------|---------|---------|
| Plant height (cm)                       | 11.45   | 11.67   | 11.73   | 11.96   | 12.01   |
| Vegetation coverage (%)                 | 75      | 75      | 75      | 76      | 77      |
| Comprehensive vegetation coverage (%)   | 52.60   | 54.50   | 58.00   | 59.20   | 62.24   |
| Fresh grass yield (kg/hm <sup>2</sup> ) | 4208.70 | 4240.05 | 4280.85 | 4303.80 | 4306.65 |

The natural grassland in the project area is divided into winter-spring, summer and autumn grassland. The winter-spring grassland in Qilian can provide 62.02% of the total forage supply. Summer pasture can provide 37.72% of the total livestock

forage supply. The supplementary feeding amount of cultivated oats, perennial forage and external mixed forage only accounted for 0.26% of the total forage supply in Qilian.

# Chapter 3 Pests and Diseases Status and Management

## 3.1 Situation of Rats and Pest Attack in Qilian

The main rats attacking the Qilian Mountains of Qinghai Province are plateau pika and plateau zokor, damaging an area of 34.349 million mu. Rats attack not only destroys the grassland vegetation and grassland ecological environment, but also reduces grassland's capacity of feeding stocks and its economic benefits, which seriously restricts the development of animal husbandry economy in Qilian County. As surveyed, in the selected area, plateau pikas attack an area of 2.3 million mu in Moeller Town's five villages, Laojigen, Hailang, Duolong and Zhasha, causing damage in a total area of 1.9 million mu where averagely one square hectometer has 278 occupied lairs. The affected area of plateau zokor in the five villages of Wajiyu, Caishitu, Laorigen, Duolong and Zhasha covers a total area of 500,000 mu, of which 450,000 mu is damaged where averagely one square hectometer has 210 occupied lairs.

The Moeller Town in Qilian County is susceptible to grassland caterpillar with frequent occurrence of pest diseases, which has developed into a serious disaster. The stricken area of grassland caterpillars is 600,000mu, of which 300,000mu is seriously damaged. The grassland caterpillars pose a great threat to the grassland ecological environment and animal husbandry production. As surveyed, the affected area of grassland caterpillars in the selected area is 300,000 mu, and the average insect population density is 10.3/mu. Their main distribution areas are shown as table 3-1.

Table 3-1 Grassland caterpillar damage in the selected area of Moeller Town

| Township<br>(town), village | Affected area<br>(10000 mu) | Damage area<br>(10000 mu) | Average pest<br>density<br>( /mu) | Minimum<br>pest density<br>( /mu) | Maximum<br>pest density<br>( /mu) |
|-----------------------------|-----------------------------|---------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Vaji Village                | 20                          | 12                        | 12                                | 8                                 | 19                                |
| Caishitu Village            | 13                          | 8                         | 10                                | 7                                 | 15                                |
| Laorigen Village            | 15                          | 10                        | 9                                 | 7                                 | 13                                |

The rats and pest attack in Moeller project area, there are caterpillar, plateau pika and plateau zokor, they destroy the grassland ecological environment and animal husbandry production. The control and management are as follows.

### 3.1.1 Grassland Caterpillar

#### (1) The biological characteristics

The biological characteristics of grassland caterpillars are as follows: grassland caterpillar is a kind of animal that belongs to Lymantriidae, with differently shaped adult male and female ones. A male moth is 7~9mm in length, black in color, growing fine yellow hair on its back, with a small head, well-developed fronts, rear wings, and three pairs of feet. A female moth is 8~14mm in length, 5~9mm in width and black in color, with a longer, round, flat body, a much smaller head. Its three pairs of feet are black, shorter, non-walkable, and its fronts and rear wings are degraded and non-flyable. It can only use the body to crawl.

#### (2) Prevention and control technology

The project area uses 1.2% nicotine-matrine to spray and control pests. The suitable control time is from mid-June to mid-July, and grazing for 15 days after spraying.

### 3.1.2 Plateau zoko

#### (1) The biological characteristics

The plateau zokor is a genus of rodents in the family Spalacidae. Their body are fat and round, lips are short, eyes are small, tails are short, and limbs are also fat and

thick. The adult coat themselves with gray- and brown-colored fur from head to tail, fur in abdomen is darker gray, and fur of babies and semi-adults are blue-gray or dark gray.

Plateau zokors usually live in lightless, closed lairs without hibernation. They mainly feed on roots of plants and breed 1 to 6 babies once a year. They live mainly in alpine meadows and meadow-turned grassland, grassland-turned meadows, alpine shrubs, plateau farmland, barren slopes and other relatively humid places of river bank terraces, mountain basins, bottomland and hillsides. They are only native to China.

#### (2) Prevention and control technology

The arrow shooting method is used to control. In order to ensure the prevention and control effect, the project has to be organized by migrant workers with rat trapping experience.

### **3.1.3 Plateau Pika**

#### (1) The biological characteristics

The plateau pika, also known as the black-lipped pika, is a species of mammal in the pika family, Ochotonidae. It is a small diurnal and non-hibernating herbivorous mammal. Without tails, the round-shaped animals are reddish tan on the top-side with more of a whitish yellow on their under-belly. Plateau pikas are unique to the Qinghai-Tibet Plateau. They are large in number and inhabit the plateau's hillsides of loose soil and river valleys. As considered as the culprit responsible for grassland degradation, it has always been a target of killing.

#### (2) Prevention and control technology

The method of bait at the hole was used to prevent and control. The specific method is to place the bait at 7 to 10 cm from the effective hole, and the hole rate is over 90%. In addition, in the area where the density of the rats is large and the distribution is uniform, the strip-shaped feeding is used, and poison bait is evenly applied every 10 m. After the bait, the grazing is prohibited for 8 to 10 days. When putting the bait, it is required to be a group of 20 to 30 people, and each of the two

putting personnel is separated by 2 to 3 m. Putting is synchronized in the same direction. After a large area of poison bait is released, if special weather such as strong winds or snowfall is encountered, the control effect will be affected. At that time, the poison bait must be added.

## **3.2 Pesticides Toxicology and Types**

### **3.2.1 Rodent Attack Control**

The pesticide used in rodent control is D-type bio-poisonous toxin. It is registered in the name of D-type Clostridium botulinum toxin in the Chinese Pesticide Information Network, and the pesticide category is rodenticide, which is divided into two types: water agent and concentrated bait. Commonly used products are 10 million or 15 million toxic price / ml of water, which is formulated into 0.1 ~ 0.2% bait, and the bait is 35 ~ 50g.

#### (1) Action toxicology

D-type Clostridium botulinum toxin is one of the neuropalatinic toxins and has proteolytic activity. After oral intake and intestinal absorption, the rodent acted on craniocerebral nerve, peripheral nerve and muscle junction and vegetative nerve endings, hindering the release of acetylcholine, causing muscle paralysis and causing paralysis of motor nerve endings. It is extremely toxic, and the rats died within 3 to 7 days after swallowing. The poison bait was placed on the grass for 6 days, and the mortality of the test rats was 90-100%; it gradually decomposed in 8-10 days, and was basically non-toxic. The peak of death of the test rats was 3 to 4 days after the bait was taken, and the rats that had been exposed to the toxin within 5 days did not produce significant drug resistance.

#### (2) Pesticide class

Clostridium botulinum toxin type D belongs to biological pesticide is used as rodenticide. It is a low toxic pesticide and is especially safe for cattle and sheep.

According to the WHO Pesticide Hazard Classification Standard (Table 3-2), Literature showed: The median lethal dose by Horn method of D-type Clostridium

botulinum toxin was LD<sub>50</sub>5840 MLD /kg。 The acute dermal toxicity: No obvious symptoms poisoning in each dose group after contamination. Clostridium botulinum toxin type D belongs to U Hazard Class.

Table 3-2 WHO Pesticide Hazard Classification Standard

| Class | Grade symbol         | LD <sub>50</sub> for the rat | LD <sub>50</sub> for the rat |
|-------|----------------------|------------------------------|------------------------------|
|       |                      | Oral (mg/kg)                 | Dermal (mg/kg)               |
| Ia    | Extremely hazardous  | <5                           | <50                          |
| Ib    | Highly hazardous     | 5-50                         | 50-200                       |
| II    | Moderately hazardous | 50-2000                      | 200-2000                     |
| III   | Slightly hazardous   | >2000                        | >2000                        |
| U     | No acute hazardous   |                              | ≥5000                        |

note: The WHO Recommended Classification of Pesticides by Hazard, 2009

### (3) Environmental effects

As a new type of biological rodenticide, D-type Clostridium botulinum toxin is not only good for the control of plateau pika, but also does not harm the natural enemies of rats. The dead rats were foraged by hawks and Tibetan foxes, and no poisoning was observed. It shows that D-type Clostridium botulinum toxin rodenticide is a highly efficient and safe biological product. It has the advantages of strong toxicity, low dosage, low cost, no secondary poisoning, good palatability, quick effect, no pollution to the environment, safety to humans and animals, and convenient use. It has a good effect on protecting the natural enemies of rodents, maintaining the ecological balance of grassland, maintaining grassland biodiversity, controlling the population of rodents to rise, reducing the spread, and protecting the grassland vegetation after treatment from damage. At the same time, the pollution of grassland by chemicals is reduced. In the treatment of grassland pests, this new biological rodent control technology can continuously control grassland pests, protect grassland ecological environment and maintain grassland biodiversity.

### 3.2.2 Pest Attack Control

Caterpillar control uses 1.2% nicotine and matrine as insecticides. Its composition is 0.7% nicotine and 1.5% matrine, and its chemical composition is

$C_{10}H_{14}N_2$  and  $C_{15}H_{24}N_2O$ , which is an alkaloid extracted from plants. The pure product is a white powder, and the commonly used agent is 1.2% nicotine matrine emulsifiable concentrate.

#### (1) Action toxicology

After spraying, once the insect touches the drug, it paralyzes the nerve center, then coagulates the protein of the insect body, blockages the stomata of the insect body, and suffocates the insect to death. After toxicity testing, the pesticide is actually low toxicity according to the acute toxicity classification standard of chemical substances, but its efficacy is high. The medication time is from 8:00 to 10:00 in the morning and from 4:00 to 6:00 in the afternoon. The spraying should be fine and uniform, diluted 1000-2000 times, and the control effect can reach 90-100%.

#### (2) Pesticide class

The matrine is a plant-derived pesticide. The rat for oral and dermal, the LD<sub>50</sub> >5000mg/kg. It is safe for animals and fish, and belongs to U Hazard Class.

#### (3) Environmental effects

1.2% nicotine-matrine as a pesticide, is a plant-derived pesticide. The main active ingredients are matrine and nicotine. It belongs to the pyridine derivative alkaloid. It is characterized by high efficiency, low toxicity, low residue, no pollution, and safe use. After 7 days, the residual amount in different crops and soils is lower than the national standard, so there is no residue problem. It has low dosage, is easily degraded in the environment, and can be rapidly decomposed in nature. The final product is carbon dioxide and water, and it has no pollution to the environment.

It is an endogenous chemical substance of plants active to harmful organisms, whose composition is not single. It is a combination of multiple groups with similar chemical results and multiple groups with different chemical structures. They complement each other and work together, and the residual effect period is long, up to 20 days. Due to a variety of chemicals work together, it is not easy to cause harmful substances to resist, and can be used for a long time. In addition, it does not directly kill the corresponding pests directly, and by controlling the population of the pests, it does not

seriously affect the production and reproduction of the plant population. Finally, it has a fertilizer effect, rich in nitrogen, phosphorus, potassium and a large number of trace elements, and the application is equivalent to fertilizing the plants. In summary, it can protect the biodiversity of the project area while controlling pests.

### **3.3 Prevention and Control of Rats and Pests**

The project combines artificial killing and biological control, popularizes biological control technology and comprehensive technology and reduces the loss to the range of ecological threshold.

This activity is in line with the co-financing of the project currently being implemented. The combination of bio-control and artificial killing is carried out, and biological control technologies and comprehensive development and utilization technologies are actively promoted to reduce disaster losses to ecological thresholds. Density survey is carried out before the prevention, and each work area is set up with 3 samples and a total of 6 samples are taken. Using a square sampling method, the sample area is 1/4 hectare. First count the number of mounds in the sample, and then dig the fresh mound in the sample to open the tunnel. Those who have sealed the hole will catch it and catch it for 3 days, and check at least 2-3 times a day. Control effect (%) = number of effective mounds before prevention - effective number of mounds after prevention / number of effective mounds before prevention × 100%.

According to the results of the previous density survey, technical measures for rats and pests are implemented. The specific method is to place the bait at 7 to 10 cm from the effective hole, and the hole rate is over 90%. In addition, in the area where the density of the rats is large and the distribution is uniform, the strip-shaped feeding is used, and poison bait is evenly applied every 10 m. After the bait, the grazing is prohibited for 8 to 10 days. When putting the bait, it is required to be a group of 20 to 30 people, and each of the two putting personnel is separated by 2 to 3 m. Putting is synchronized in the same direction. After a large area of poison bait

is released, if special weather such as strong winds or snowfall is encountered, the control effect will be affected. At that time, the poison bait must be added. Before placing the bait, all the herders in the prevention and control area should be notified in time, and the livestock should be transferred to the pastures outside the control area for grazing. The control area prohibits grazing within 8-10 days after the poison bait is placed to prevent accidents. The rate of decline of rats and insects will be checked within 5-7 days after prevention.

The project combines artificial killing and biological control. Under the No-till seeding、Spring-forbidden grazing, the increase of grassland coverage and the increase of biomass in the above ground part of grassland, are disadvantageous to the survival of rodent, this can restrain the rodent damage.

# **Chapter 4 Environmental Impact and Mitigation Measures of the Project**

## **4.1 Site selection of the project area**

### (1) Project area selection

Qinghai province has an important ecological strategic position and it is the birthplace of China's most important rivers contained the Yangtze River and the Yellow River. Qinghai province is located at the northeast of the Qinghai-tibet plateau, and it has abundant grassland resources and diverse grassland types, the distributed alpine grassland is an important part of the ecosystem of alpine grassland on the Qinghai-tibet plateau, and also is an important foundation of grassland animal husbandry. The alpine grassland ecosystem in Qinghai is sensitive to climate change, due to its characteristics of high altitude and cold; the grassland ecosystem is relatively fragile and significantly affected by climate change.

Qilian, Qinghai province is chosen to carry out this project. After nearly five years of preparation, especially through the world bank organization project's identification, preparation, pre-evaluation, evaluation and other stages, the project offices at all levels have become increasingly clear about the objectives and tasks of the project; The government of the project area has a very high enthusiasm to participate in the project, and the government strongly uses the policy environment and supporting funds to support the project, and promises to do the actual work according to the requirements of the project, even for the implementation of the project, the supporting funds required by the project will be in place on time regardless of manpower, material resources and financial resources. The awareness and understanding of the masses in the project area has been deepening, and the support of each implementation subject to the project has been increasing, which has laid a solid foundation for the smooth implementation of the project.

The project area is the base for the development of grassland animal husbandry, at the same time, there is excellent herbage and local livestock species such as Qilian Mountain yak, Tibetan sheep, white yak, white Tibetan sheep, Shandan horse, red deer are distributed, which are of vital importance to the restoration of local grassland ecosystem. On the one hand, local livestock and poultry varieties have strong adaptability, which can provide good genetic resources for the restoration of degraded grassland ecosystem. On the other hand, local animal husbandry varieties have the characteristics of high fertility, resistance to roughage, strong disease resistance and good quality, which are important components of grassland biodiversity. Grassland biological resources are an important gene bank to meet production needs and cope with climate change, and many varieties of grass and livestock bred abroad are based on local varieties after years of breeding, and protecting the existing local grass and livestock variety resources in the project area can lay a foundation for the future breeding of new varieties of grass and livestock.

The project area has carried out ecological restoration in grassland ecosystem, grassland production promoting energy conservation and emissions reduction and carbon sequestration capacity of experiment and demonstration, and initially had the intensification and the trend of the development of the industrialization, and it can represent the climate smart grassland ecosystem management mode of project development direction and have further accumulates promotion demonstration of the basic conditions. All the conditions and indicators in the project area are relatively stable and representative, and the implementation area is concentrated and contiguous and the local grassland research and technology demonstration and promotion institutions are sound.

According to the principle of site selection (representativeness principle, direction principle, feasibility principle, the government attaches importance to the principle, the voluntary principle of herding), the selection conditions and application process, the above process and election principle, after expert evaluation, Qilian, Haibei prefecture, Qinghai province is selected to participate in this project. The project organization and coordination departments of the above-mentioned counties select Moeller town to participate in the implementation of the project

according to the selection criteria of the project township.

The implementation of the project finally determines 27 natural villages and 6 administrative villages in Moeller town, Qilian, Haibei prefecture, Qinghai province.

(2) Selection of project implementation area

There are 6 administrative villages in Qilian county Moeller town, each administrative village randomly selected 2 or 3 natural villages as project processing village, each processing village selected 3 mutual-aid groups, each mutual-aid group selected 4 as project households, finally selected 160 households as implementation project households to implement the project.

(3) Location relationship between project area and protection area

According to the latest 2015 list of national nature reserves published on the website of the ministry of environmental protection of the People's Republic of China, there are 11 nature reserves in Qinghai province. See screenshot 4-1 for their names and administrative areas.

| 序号  | 保护区名称   | 行政区域         | 面积       | 主要保护对象              | 类型   | 级别  | 始建时间     | 主管部门 |
|-----|---------|--------------|----------|---------------------|------|-----|----------|------|
| 青01 | 大通北川河源区 | 大通回族土族自治县    | 107870   | 高原森林生态系统及白唇鹿、冬虫夏草等珍 | 森林生态 | 国家级 | 20051017 | 林业   |
| 青02 | 循化孟达    | 循化撒拉族自治县     | 17290    | 森林生态系统及珍稀生物物种       | 森林生态 | 国家级 | 19800403 | 林业   |
| 青03 | 青海祁连山   | 祁连县、门源县、德令哈市 | 794399.6 | 森林生态系统及冰川、高寒湿地生态系统、 | 森林生态 | 省级  | 20051230 | 林业   |
| 青04 | 青海湖     | 刚察县、共和县、海晏县  | 495200   | 黑颈鹤、斑头雁、棕头鸥等水禽及湿地生态 | 野生动物 | 国家级 | 19750821 | 林业   |
| 青05 | 隆宝      | 玉树县          | 10000    | 黑颈鹤、天鹅等水禽及草甸生态系统    | 野生动物 | 国家级 | 19840801 | 林业   |
| 青06 | 三江源     | 玉树县、囊谦县、杂多县  | 15230000 | 珍稀动物及湿地、森林、高寒草甸等    | 内陆湿地 | 国家级 | 20000523 | 林业   |
| 青07 | 可可西里    | 治多县          | 4500000  | 藏羚羊、野牦牛等动物及高原生态系统   | 野生动物 | 国家级 | 19951005 | 林业   |
| 青08 | 格尔木胡杨林  | 格尔木市         | 4200     | 胡杨及其生境              | 野生植物 | 省级  | 20000523 | 林业   |
| 序号  | 保护区名称   | 行政区域         | 面积       | 主要保护对象              | 类型   | 级别  | 始建时间     | 主管部门 |
| 青09 | 柴达木梭梭林  | 德令哈市、乌兰县、都兰县 | 373391   | 以梭梭为主的荒漠植被类型        | 荒漠生态 | 国家级 | 20000523 | 林业   |
| 青10 | 可鲁克湖托素湖 | 德令哈市         | 14770    | 湿地生态系统及水禽           | 内陆湿地 | 省级  | 20000523 | 林业   |
| 青11 | 诺木洪     | 都兰县          | 118000   | 荒漠生态系统及野生动植物        | 荒漠生态 | 省级  | 20051017 | 环保   |
| 宁01 | 宁夏贺兰山   | 银川市西夏区、永宁县   | 193535.7 | 森林生态系统、野生动植物资源      | 森林生态 | 国家级 | 19820701 | 林业   |

Figure 4-1 list of Qinghai nature reserves in the list of national nature reserves

In Qilian Mountain, Qing03 is associated with the project area Qilian County. The scope of the national park reserve in Qilian Mountains is shown in Figure 2-2.

The location relationship between Moeller town in Qilian county and Qilian Mountain national park is shown in Figure 4-2. The green part in the figure is the scope of Qilian Mountain national park protection area, the black part is Qilian County and the red part is Moeller town. As can be seen from the location in the

Figure4-2, Moeller town is located in the southeast of Qilian County, and only the northwest part of its distribution is look like to overlap with the protected area (The distribution of the protected areas is now in the publicity period, and the detailed distribution is yet to be announced). What may touch the protected area is the summer grassland in the northwest part of Moeller, with the selection of protected areas, the government will notify the herdsmen where will be protected area, to fence the protected area and forbid them to enter the protected areas. Therefore, it will be excluded when the project selecting the Implementation households. So it ensures that the project areas will be outside the scope of the protected area.



Figure 4-2 location diagram of Moele town and Qilian Mountain national park in Qilian

#### (4) Principle for site selection of project area

Firstly, the grassland households in the protected area of Qilian Mountain National Park should be screened, and excluded from the random screening of this project, so that the demonstration sites in the protected area can be excluded, so can ensure that the project implementation site do not touch the protected area.

The land for reseeding on grassland should comply with the national and local policies and relevant regulations on grassland restoration. The land for manual

planting grass only uses the horizontal circle of each herdsman, the horizontal circle is the pasture supplied by herdsman, which is allowed to grow herbage to support animals, the nature of the land is planned to be cultivated land and herbage is allowed to grow. Exclude other nature of grass planting.

## **4.2 Environmental impact of project implementation and control measures**

### **4.2.1 Environmental and social benefits brought by project implementation**

(1) Increase of soil carbon sequestration in grassland and improvement of grassland quality in project areas

This project can help to increase the grass yield of grassland through techniques such as grassland replanting and manual planting grass etc; can relatively reduce the livestock-carrying capacity of grassland, restore the pasture, and increase the coverage of vegetation and the proportion of fine forage by taking the combined measures of livestock grazing and barn feeding system in the project area; and also can promote the grassland ecosystem to a virtuous circle and increase the carbon sink of grassland soil.

(2) Restoration of Grassland Biodiversity

With the improvement of grassland quality and the coverage of grassland vegetation, the restoration of grassland vegetation can reduce the occurrence of rodent damage; it can restore the grassland, promote the benign development of grassland and benefit the restoration of biodiversity, combined with the biological control of rat and pest and reduction of pesticides. It can also restore the grassland landscape pattern and promote the sustainable development of grassland ecosystems with the improvement of the ecological environment in the project area.

(3) Improvement of water quality in the project area and its downstream areas

The restoration of grassland can reduce the surface runoff, prevent soil erosion, conserve water sources, and protect wetlands; In addition, the restoration of grassland can reduce the harmful substances go into rivers, thus contributing to the

protection of the water source of the Yangtze and the Yellow River.

(4) Improve the ecological environment quality of Heihe river watershed in Qilian Mountains

After the implementation of the project, the grassland degradation, desertification, rodent and pest situation has been significantly improved, the grassland vegetation restoration, soil erosion has been contained, the grassland water storage and sand fixation capacity has been strengthened, the ecological environment of the project area has been improved, and it has made a contribution to the overall improvement of the ecological environment of the Qilian Mountain-Heihe river Watershed.

(5) Changment of herders' traditional grazing habits and more intensive and efficient grazing

The implementation of this project can help to change herders' habits of grazing on natural grasslands all year round. Grassland management activities such as spring-forbidden grazing, captive feeding and manual planting grassland construction can not only enable grassland to recuperate during key periods such as grass germination and seed maturity, but also reduce the fat loss of livestock to some extent; The optimized forage combination can also help to adjust the nutritional structure of the livestock, making the animal husbandry more intensive and efficient.

(6) Changing the herders' ecological subsidies and reward concept, encouraging them to voluntarily protect grassland resources

The existing ecological subsidies and reward policy in the project area is distributed to each household according to the grassland area contracted by the households according to the standards of the grazing prohibition and grassland balance subsidy. The evidence-based payments for ecosystem services policy implemented by the project will implement the ecological subsidies and reward policy in strict accordance with the approved stocking standards, that is, the participating households will compensate for the losses caused by reducing livestock, and reward for the supply of ecological products with grassland protection. The implementation of the 5-year project and its demonstration effect can improve the herders' opinion of subsidies and reward, and the herders will be encouraged to

voluntarily protect grassland resources under the new ecological subsidies and reward mechanism.

(7) Enhancing herders' ability to accept new technologies and improving their sustainable livelihood

During the implementation and demonstration of the project, we will provide consultation and guidance on animal husbandry technology, and use the agricultural technology promotion platform and the Agricultural Broadcasting and Television School to train new types of professional farmers and herders, improve the technical acceptance of herders, enhance their human capital, and broaden their livelihoods. After taking the technical adoption, the livelihood improvement of the participant pastoral households will expand the positive effects to other pastoral areas, and finally make a sound and rapid development of pastoral areas.

#### **4.2.2 Environmental impact and prevention measures during the construction time**

##### **4.2.2.1 Environmental impact of during construction time**

The main environmental impact factors of the project during construction time include air pollution, water pollution, and noise pollution; waste and so on. During the construction time of this project, the activities that have an impact on the environment contain grassland fence reinforcement, no-till reseeding and manual planting grass.

###### **(1) Reinforcement of grassland fences**

The main sources of air pollution are: during the construction period, dust may occasionally be generated, and the exhaust gas generated by vehicles transporting materials for fences may have a certain impact on the atmospheric environment around the construction site; In the construction process, if the original fence is removed and cleaned, it will also produce dust, causing a certain adverse impact on the atmospheric environment. Therefore, construction dust, vehicle exhaust will pollute the construction scope and the length range of surrounding road.

Water pollution mainly includes: construction and production waste water and

workers' domestic sewage. The construction of the fence strengthening activity does not produce waste water. The domestic sewage mainly belongs to the construction workers, all of whom belong to the local residents, so it only involves the construction workers' catering and excrement sewage.

The main sources of noise during construction are construction noise and motor vehicles.

During the construction time, the main sources of solid waste include: construction waste and household waste, etc., mainly from the demolition and replacement of debris involved in the fence reinforcement, and household waste of construction workers.

## (2) Reseeding on grassland

Reseeding is a semi-artificial, near natural restoration measure, which refers to sowing pasture with strong adaptability and high forage value on the grassland without destroying or destroying the original vegetation, in order to increase the species composition of grassland community and increase the surface improvement, and it is also an effective measure for vegetation restoration and improvement.

This project will use no-tillage seeding to work on degraded alpine meadow. During the soil thawing period before the spring rainy season, the project will complete the ditching, sowing, covering and suppression of soil at same time, and reseed the excellent herbage, so as to minimize the damage to the native vegetation of degraded meadow. Selecting sows in the group of natural grass is suitable for the growth of the Qilian Mountain perennial gramineous forage grass seed, selection *Elymus nutans*: Qinghai Chinese fescue: Qinghai grass *Poa pratensis* 1:1:1. The seed quality requirements meet the standards of Grade 3 or higher as specified in GB 6142. The seeds are depilated before planting to meet the requirements of mechanical sowing. The sowing amount is 15~20 kg/hm<sup>2</sup>, and the sowing depth is 2~3 cm. It was forbidden to graze in the reseeded year. From the second year, grazing is prohibited from the end of April to the beginning of June when the pastures return to green.

This project adopts reseed fill no-till seeding machine to seed, its working process is: break shovel will loose soil and cutting off the grassroots, using the pipe

to put the fertilizers into the soil, crusher break the soil into pieces, and make the soil and fertilizer mixing, using the pipe sent seeds into the soil, repressor will mild compact the surface soil, the whole seeding operation is complete. In the process of mechanical no-tillage reseeded, soil surface crushing, sowing, fertilization and soil re-coverage compaction are completed at same time, and the impact on grassland is minimized. The compaction process not only avoids the loss of grass seed but also soil erosion caused by loose soil surface. The impact on the environment is relatively small, but the re-seeding of grass will impact and damage to the original soil structure and grassland vegetation, which will lead to the change of ecological structure within the re-seeding range.

### (3) Manual planting grass

The project uses livestock sleeping circle for the manual planting grass, its present situation is the growth weed, and the grass quantity production capacity is low. To choose tall Qingyin no.1, no. 2, Qinghai 444, precocious oat and Vicia sativa for manual planting grass, established stable, high-yield manual planting grassland.

In this project, no-till is adopted for seeding. The seeding rate is 100 kg/hm<sup>2</sup>, and the sowing depth is 3-4 cm. The seeding method is a drilling tillage. Sowing time is in mid-May. After the broadcast, repression is carried out to ensure that the sputum and the emergence are neat. In the autumn, castration is used to prepare hay and storage for high-quality forage for livestock feeding.

The manual planting grass project is a small project, although it will cause a certain degree of trauma to the native land, but because of the no-till method, seeds are sown and covered immediately after ditching, and the environmental impact disappears with the growth of herbage. In the planting season, the native grassland ecosystem will be disturbed to some extent.

#### **4.2.2.2 Preventive measures during construction time**

##### (1) Dust pollution control

The closer to the construction site, the greater the concentration of dust in the air will be. Since the project is fence-reinforced, the amount of work is very scattered and the length involved is long. However, the amount of work in each construction area is small. In addition to being on vast grassland and has little impact on the

environment. If the local area involves dismantling or a large amount of work, sprinkler measures can be taken at the construction site to reduce the dust concentration at the construction site. Minimize the impact of dust generated during construction on the surrounding environment. If it is removed, it is recommended to remove the removed materials as soon as possible to avoid stacking affecting the environment. Considering that construction, material transportation and loading and unloading are all phased operations. With the end of the construction, the impact of dust on the surrounding atmospheric environment will also end.

Manual planting grass and grassland reseeding: dust will be generated in ditching. After ditching, seeding and soil covering will be completed together, with a small amount of production, and it is located in wide grassland, and its impact on the environment is acceptable. It is suggested that the manual planting grass should be carried out in sections, and the furrows, seeds and soil covering should be completed at the same time to minimize the impact. And reseeding should be carried out separately to avoid one-time planting in large area. With the end of planting, the impact of dust on the surrounding atmosphere also ends.

#### (2) Water pollution control

The domestic sewage in this project mainly comes from the construction workers, and most of them belong to local residents. If the construction area is far away from the residential area, its catering and fecal sewage should be abandoned away from the water source. Avoid contaminating nearby water bodies. The domestic sewage of this project is limited to the construction period and the relative time is short. After the above water treatment measures, the influence of construction domestic sewage on the surrounding water environment can be effectively prevented.

#### (3) Noise pollution control

Construction noise generally affects the acoustic environment of sensitive points such as villages within 200m along the line. Some transport vehicles will have a certain impact on the residential area near the embankment. Due to its vast grassland, it is not sensitive to environmental impacts, and only areas adjacent to the home will have an impact. It is recommended to control construction time in these

areas. The project is limited to construction during the day and avoids lunch breaks (12:00~14:00). Ensure that the noise value at the noise sensitive target meets the requirements of the Acoustic Environmental Quality Standard (GB3096-2008).

#### (4) Waste control

The solid waste generated during the construction period is mainly the material waste and domestic garbage that may be replaced during the fence reinforcement process. Material waste and domestic garbage should be stored separately. Material waste should be cleaned up and disposed of in time, and domestic garbage should be taken back to the living area for treatment.

#### (5) Ecological impact control

During the construction period, the grassland vegetation within the construction area may be damaged and the soil erosion will be aggravated. Therefore, during the construction period, the rainy season (May-August) should be avoided to reduce soil erosion.

During the sowing of herbage, should avoid the early dry season in spring. In the process of no-tillage reseeding, the process of sod cutting, soil loosening, reseeding and covering is adopted to reduce soil disturbance and soil erosion, and at the same time, it can better retain heat, retain moisture and resist drought, and promote the grass growth. According to the topography, the zoning of planting grass was carried out, and adopts measures according to local conditions and implement them step by step.

### **4.2.3 Impacts on the environment during operation and mitigation measures**

After the construction of fence reinforcement activities, no more pollutants will be generated.

In the technical part of the project, the grassland yield is increased by means of grassland reseeding and manual grass planting. At the same time, the livestock stocking system is implemented to reduce the carrying capacity of grassland. This will restore the pastures in the project area and increase the vegetation coverage. Combine the biological management of rats and insects to reduce the amount of

pesticides used. The restoration of pastures will also reduce the occurrence of rodents. The implementation of the project can promote the benign development and restoration of grassland and promote the sustainable development of grassland ecosystem. With the restoration of grassland, it can also reduce soil erosion, conserve water and protect wetlands, and contribute to the protection of the source water of the Yangtze and Yellow Rivers. Therefore, the environmental impact during the operation period is a good aspect.

#### (1) Manual planting grass

The environmental impact of manual planting grass mainly includes tillage and manual grassland cultivation. The manual grass sowing will affect a small range of biodiversity.

The main measures include: In manual grassland cultivation, use organic fertilizers produced from local livestock as much as possible, and avoid the impact of chemical fertilizers on soil structure and properties.

The selected land is mainly the livestock sleeping circle, and the grass seed is selected as the local dominant herbage as the manual planting grass species. As long as the management is strengthened, the project implementation will not have a great impact on the environment of the project area, which is acceptable.

#### (2) Pest control and prevention technology

For pest control in the project area, 1.2% nicotine and matrine (U Hazard Class) are used as insecticides to spray in the harmful area; the appropriate time for control is from mid-june to mid-july. After spraying, grazing is banned for 15 days.

As an insecticide, 1.2% nicotine and is a plant derived pesticide. The main active ingredients are matrine and nicotine, which belong to pyridine derivative alkaloids and have the characteristics of high efficiency, low toxicity, low residue, no pollution and safe use. After 7 days, the residue in different objects and soil is lower than the national standard, so there is no residual problem. Low dosage, which is easy to get degradation in the environment, in nature it also can be rapidly decomposed, the final products are carbon dioxide and water, and it have no pollution to the environment. At the same time, this agent is rich in nitrogen, phosphorus, potassium and a large number of trace elements, which have fertilizer

effect on crops. Control pests with preserving biodiversity in the project area.

There are two kinds of rodent control measures in the project area: Firstly, the plateau zokors are controlled by shooting with bows and arrows, which will not affect the environment and is required to protect the working staff, the project is organized and implemented by the construction party that wins the bid and employs the migrant workers who have experience in catching rats. Pikas in the plateau are controlled by baiting from the mouth of the cave. In order to ensure the safety of livestock, grazing is strictly forbidden in the control area, and grazing must be banned for more than one week in the baited area.

The pesticide used in rats was D-type Clostridium botulinum toxin (U Hazard Class), which was ingested by the mouth and absorbed by the intestine and then acted on the junction of cranial and cerebral nerves, peripheral nerves and muscles, as well as plant nerve endings, resulting in muscle paralysis and motor nerve endings paralysis, and it was extremely toxic, and the rats died within 3~7 days after being swallowed. As a new biological rodenticide agent, it not only has good control effect on plateau pikas, but also does not harm the natural enemies of rats, the dead rats were pecked by eagles and Tibetan foxes and no poisoning was observed. It is strong toxicity, low dosage, no secondary poisoning, no pollution of the environment, even safety to human and animal. In the management of grassland rodent, this new biological rodent control technology can continuously control grassland rodent, protect grassland ecological environment and maintain grassland biodiversity.

### (3) Efficient breeding technology of Tibetan sheep and yak

The environmental impacts of Tibetan sheep and yak breeding mainly include odor, excrement and urine, and animal and poultry epidemic prevention.

In this project, Tibetan sheep and yak breeding were kept in the enclosure during the period of grazing ban, the enclosure feeding in the local area was open, with good air circulation, which was naturally discharged into the air. Because it is herdsman scattered breeding, the environmental impact is very small. There is no large number of residents in the surrounding areas, only farmers and herdsmen live nearby, which will not affect the residents.

Moeller town belongs to the northwest region of China. The livestock and

poultry excrement coefficient is converted to the manual of livestock and poultry industry source production and sewage coefficient issued by China in 2009 as an important basis. In addition to other relevant literature, the livestock and poultry sewage coefficient and nutrient average content in this region are shown in Table 4-1.

Table 4-1 sewage coefficient and nutrient average content of livestock and poultry excrement

| Animal species | Fecal resources (kg/d) | TN (g/d) | TP (g/d) |
|----------------|------------------------|----------|----------|
| Beef cattle    | 20.42                  | 104.1    | 10.17    |
| Sheep          | 0.87                   | 2.15     | 0.46     |

Table 4-1 shows the sewage coefficient and nutrient average content of livestock and poultry manure. According to the number of various livestock and poultry in Moeller town in 2018 (365 days per year), the production volume of livestock and poultry manure in Moeller town in 2018 and the nutrient content contained in these feces are shown in Table 4-2.

Table 4-2 livestock and poultry manure production and nutrient content in Moeller in 2018

| Animal species | Fecal resources (t/a) | TN (t/a) | TP (t/a) |
|----------------|-----------------------|----------|----------|
| Yak            | 714518.06             | 3642.57  | 355.86   |
| Tibetan sheep  | 99571.93              | 246.07   | 52.65    |

According to the situation in the project area, cow and sheep manure can be treated and applied as resources, fertilizer utilization. The manure is collected and stacked in the yard of herdsman for air drying. In winter, it can be used as heating material according to the habit of herdsman, the rest can be compost as organic fertilizer, apply organic fertilizer to manual planting grass in spring every year as fertilizer, instead of chemical fertilizer, reduce the impact of chemical fertilizer on the environment, at the same time to cultivate soil; extra organic manure can be applied to pasture.

According to the calculation, the annual amount of livestock and poultry excrement produced by Mohler town in 2018 is 814,000 tons, equivalent to 3888.6 tons of nitrogen and 408.5 tons of phosphorus. Moeller town covers 5.7402 million mu, equivalent to 382,700 hm<sup>2</sup>. Some studies have shown that the amount of nitrogen applied to large-scale fertilizer should be controlled at 150-180 kg/hm<sup>2</sup>,

beyond which the environmental pollution will be caused. It was calculated that if all the manure was returned to the field as fertilizer, the nitrogen application amount could reach 10.16 kg/hm<sup>2</sup>, far below the threshold value. Some studies have shown that the application amount of phosphorus in soil manure should not exceed 80 kg/hm<sup>2</sup>, according to calculation, if all the manure is returned to the field as fertilizer, the application amount of phosphorus can reach 1.67 kg /hm<sup>2</sup>, much lower than the threshold value.

So, the land in Moeller town is strong enough to apply the manure.

## **4.3 Safety and health**

### **4.3.1 Breeding and epidemic prevention measures of Tibetan sheep and yak**

(1) The bank's EHS need “guidelines for environmental, health and safety in the field of livestock feeding mammals”.

#### **Animal diseases**

Substances that cause animal diseases can increase rapidly, especially in high-density copper farming of livestock, where animal diseases may enter feeding facilities with the arrival of new animals, equipment and humans. Some diseases can make large numbers of livestock become weak, even die in infected facilities. Sometimes, the only viable option on a farm is to sacrifice large numbers of animals, so as to prevent disease from spreading to other parts of the facility or to other facilities. Methods of preventing the spread of animal diseases depend on the type of animal in the facility, the way the disease is transmitted and infected, and the degree to which the animal is susceptible to each disease.

The key to developing effective disease prevention measures is to obtain accurate information about animal diseases and how to prevent them. The following general management measures are recommended to reduce the likelihood of transmission of animal pathogens:

- Control into animals breeding facilities, equipment, personnel, wildlife, livestock (for example, quarantining the new animals, cleaning and disinfecting

the container, Workers sterilize and cover shoes before entering livestock areas, and provide workers with protective clothing, closed the holes of the structure to prevent wild animals into breeding facilities);

- For vehicles traveling between feedlots(e.g., vehicles transporting veterinarians, feeder products suppliers, product buyers, etc.), should take special precautions, such as restricting the movement of these vehicles in special areas, adopting biosecurity measures and spraying tyres and car parks with disinfectant;
- Sterilizing the animal enclosure;
- Identify and isolate sick animals, and establish appropriate management procedures for the removal and disposal of dead animals.

#### **Animal carcasses**

Animal carcasses should be properly managed and promptly disposed of to prevent transmission of diseases (see section on "animal diseases" above) and emit odors, and to prevent the introduction of vectors.The operator shall implement the actual management and treatment system and shall not recycle animal carcasses into animal feed. It is suggested to adopt the following management methods which are as follows:

- Reduce animal mortality through appropriate animal care and disease prevention measures;
- Store them before collecting animal carcasses,they should be refrigerated if necessary to prevent spoilage;
- Use a reliable carcasses collection company which be approved by the local authority, which uses the method of burial or incineration (depending on the cause of death) to dispose of the carcasses. Incineration sites must be incineration facilities authorized to operate in accordance with internationally recognized standards to avoid and control pollution;
- In the absence of a method of animal carcasses approved by the authorities, on-site culling may be the only viable option (if the authorities allow it).The site must be accessible to excavation equipment, both on-site and off-site, and the soil should be stable and low permeable, with enough insulation to separate it from the house and water to prevent contamination by gases or filtered materials

from the buried corrupt material.

(2) Epidemic prevention measures in the project area

Veterinary stations are especially responsible for epidemic prevention in the project area, the responsibility system for epidemic prevention and control is implemented, both administrative and professional work responsibilities are taken at the same time, administrative for density control, professional work for quality. Every township in Moeller Town has animal husbandry and veterinary station, which has fixed funds. Animal husbandry and veterinary station collects and hires vehicles to carry out for harmless treatment when the animals died of diseases are reported to the herdsman. The treatment mode is deep burial, and the location is chosen to be far away from the water source to avoid contamination of surface water and groundwater.

According to the ministry of agriculture “Technical Specification for the Harmless Treatment of Dead and Diseased Animals” notice:

Site selection requirements: should choose dry terrain, and in the downwind location; stay away from schools, public places, residential areas, villages, animal feeding and slaughtering sites, drinking water sources, rivers and other areas.

Technology: the volume of the buried body is determined by the actual animal carcasses and the related animal products quantity. The bottom of the deep pit should be more than 1.5m above the Groundwater level, need to Anti-seepage and anti-leakage; put a layer of quick lime or bleaching powder with a thickness of 2-5cm at the bottom of the pit. Put animal carcasses and related animal products into the pit, the top layer more than 1.5m away from the surface, disinfectant such as quick lime or bleaching powder, cover the soil 20-30cm from the surface with a thickness of no less than 1-1.2m.

Operation attention: the soil can't be too hard by burying to let gas bubbles emissions and liquid leakage caused by corruption. After deep burial, a warning mark shall be set up at the site of deep burial. After deep burial, the inspection shall be once a day in the first week, once a week in the second week and continuously for 3 months, and the collapse place of the deep pit should be covered with soil in time. After deep burial, immediately use chlorine preparation, bleach powder or

quick lime and other disinfectants to thoroughly disinfect at once. The first week should be disinfected once a day; the second week should be disinfected once a week, continuous disinfection for more than three weeks.

#### **4.3.2 Construction safety and health analysis**

Contractors and regulatory agencies have responsibility to take every measure to ensure safety of workers and structures around the construction sites and to prevent them from accidental damages. Contractors capable of managing their employees' occupational health and safety matters shall be employed, and the contractor shall also be required to enforce the enterprise's hazard management rules through formal procurement agreements. Construction safety and health of the project includes the design and operation of general facilities, communication and training, and supervision.

#### **4.3.3 Construction safety and health measures**

Contractors should be responsibility to obey by national and local regulation and requirement on safety, to avoid accidental event, and to ensure their workers' safe and health.

(1) Contractors should ensure the provision of up to the mustard first aids. Tools for first aids should be provided.

(2) All new construction workers should be trained in occupational health and safety, and introduced the basic working rules, personnel protection rules, and ways to prevent themselves or others from being hurts;

(3) Contractors should furnish their workers with personnel protective equipment;

(4) The construction site should be equipped with sunstroke supplies, reasonable arrangements for rest time, when high-temperature operation;

(5) Constructor shall establish procedures and systems for reporting and recording occupational accidents and diseases and dangerous situations.

#### **4.3.4 Implementation principles of pest control**

(1) Promote and apply integrated pest management (IPM) technology in project areas, including implementing biodiversity monitoring, strengthening the prediction and forecast of pests and rats, protecting and utilizing natural enemy resources, applying physical control technology and biological comprehensive control measures, and reducing the adverse impact of chemical pesticides on the environment and human health. During the implementation of the project, the integrated measures of agriculture, physical, biological and chemical control were adopted to control pests and rats, reduce dependence on chemical pesticides, cultivate good application behavior, and recycle and harmless treatment of pesticide packaging waste.

(2) Improve farmers' practical operation skills and train them to master comprehensive pest control skills through participatory learning methods such as field schools. Provide training on safe and scientific use of pesticides for farmers in the project area, and improve herdsmen's understanding of pesticide management and use regulations. Provide training for technical staff of the promotion department, pesticide distributors and municipal (county) project offices to raise their awareness of IPM.

#### **4.3.5 Principles of pesticide use**

- (1) Harmless to human health;
- (2) Obvious effects on target species;
- (3) It has little impact on non-target species and environment;
- (4) Do not use the same drug repeatedly; Avoid developing resistance to pests
- (5) It is an agricultural biological pesticide with high efficiency, low toxicity, low residue or no residue.

The pesticides to be purchased and used in this project should meet the world bank's WHO recommendations for classification of pesticides based on hazard and classification guidelines (Geneva, WHO, 1994-1995).

This project will not purchase pesticide which are forbidden to use, without registration, or WHO I 、 II pesticide.

#### **4.3.6 Labor safety**

(1) Regularly publicize national, provincial and municipal laws, regulations and management systems on production safety to the staff of the project implementation unit, so as to make the project implementation worker keep production safety in mind at all times and prevent problems from happening. In addition, the project implementation unit will formulate rules and regulations and operation process of work safety and labor protection, and clarify the person who is responsible for work safety; Sign labor contracts with employees; carry out safety production education and training regularly, so that everyone has the awareness of safety production.

(2) Regularly distribute labor insurance supplies. Provide special clothes, shoes and hats to employees, and different styles and colors shall be managed according to different work positions. Employees should wear neat work clothes and hats at work.

# **Chapter 5 Project Implementation Impacts on Ecological Environment**

## **5.1 Invasive alien species damages and mitigation strategies**

### **5.1.1 Risk assessment of invasive alien species**

Alien species are species, subspecies, or low taxonomic groups which are not native to the specific locations, including any part, gamete, or propagule that can survive and reproduce. Invasive alien species refers to that a biological species migrates from an original place to a new ecological environment caused by the natural effects or human activities. It has two factors; firstly, the species must be adventive and non-native, and second, the alien species can settle, self-propagate and spread in local natural or artificial ecosystems which ultimately affect the local ecological environment and damage local biodiversity.

The effects may be caused by project activities including:

(1) When pasture grasses are used as the artificial grasses, the economic benefits are mainly considered, and its ecological effects may be neglected. Pasture grasses also have the similar characteristics of weeds, such as rapid reproduction, wide adaptability, strong resistance, and etc. From a human perspective, the continuation of pasture grasses under artificial habitats requires human intervention, while weeds can breed and continue under the living conditions of artificial habitats. If a particular pasture grass species is used as artificial grass that can still reproduce naturally in the process of cultivation without human intervention, it becomes weeds, that escape to wild species, which has risks or potential risks for environment. Moreover, the risk level is directly proportionally related to the natural continuation ability of the plant in artificial habitats. The harmfulness depends on the plants' sustainable ability that brings increasing amount to artificial habitats, which means

the occupation of natural resources and space will be more. If the plants directly or indirectly affect the life safety of humans and animals or cause a huge impact on crops, it will be more harmful.

(2) Artificially planting a large area of a single pasture species can reduce community diversity and makes the environment more susceptible to be invaded by other alien species. Changes in plant communities also cause changes in ecological processes, such as changes in normal fire cycle which increase the frequency of fire accidents.

Pasture species can not be only invasive creature caused by artificial grass introduction because the dangerous insects and microorganisms that may be carried by pasture grasses. It is a concealment danger possibility.

(4) Oats are annual high-quality grasses, which are more resistant to land poorness, cold and drought. Oat seed may have been mixed with wild oat seed, which is a worldwide problem about uncontrolling weeds.

(5) Alien forage (pasture grass) causes alien species.

### **5.1.2 Environmental prevention of Biological invasion**

In terms of grass species selection, through the screening and selecting experiment of pasture grasses. Qinghai province had formulated the technical procedures and regulations about introduction of pasture in alpine pastoral areas. Based on the experimental research results and the current status of grass seed industrialization, it is recommended that *Elymus nutans*, *Elymus breviaristatus* cv. Tongde, *Elymus sibiricus* Tongde, Qinghai Chinese fescue, *Puccinellia tenuiflora* cv. Tongde, Qinghai grass *Poa pratensis* are the most preferred grass species for environmental governance with large-scale application in black soil beach problems. For rapidly vegetation development and restoration of black soil beach problem, the first new root-stem-type plateau forage species- Qinghai grass *Poa pratensis* had been successfully domesticated. The technical procedures and regulations about Qinghai meadow precocious grass plant cultivation and seed production had been developed. A 1000hm<sup>2</sup> seed manufacturing base was

established. In addition, through years of breeding, a number of annual oat varieties which are suitable for alpine climate conditions have been cultivated, such as Qingyin No.1 and Qingyin No.2.

(1) Selection of grass species in no-tillage and pasture grasses reseed activities

The grass species selected for the project, the perennial grass forage grass species which are suitable for growing in the Qilian Mountains's natural grass groups- *Elymus nutans*, Qinghai Chinese fescue, Qinghai grass *Poa pratensis*. The three kinds of grass have been mixed according to the ratio of 1:1:1; the seeding amount was 15~20 kg/hm<sup>2</sup>, and the planned reseeding area was 8000 mu.

*Elymus nutans* and Qinghai grass *Poa pratensis* are perennial gramineous grasses, which are native pastures in the Qilian Mountains. Alpine meadow is the most widely distributed grassland type in Qilian County. The main dominant species are gramineous plants and the main plants of alpine meadow are *Elymus nutans* and *Poa pratensis*.

*Elymus nutans* have the features of growing vigorously, having high crude protein content and giving good palatability. It has been widely used in the improvement of alpine degraded pastures and the construction of artificial grassland. In the project area-Mole Town, the alpine meadow grassland's important value is 18.47, which is in the first domination. Gramineous *elymus nutans* is the most widely distributed and most common short-term perennial grass. It generally survives for 4 years and has the highest yield in 2 to 3 years. In the production and construction of grassland in the pastoral area of above 3000~4200 m altitude, *elymus nutans* is mainly used for both grazing and cultivating, which can effectively prevent soil erosion. It is one of the most common grass species used for reseeding grassland or establishing artificial grassland in alpine pastoral area.

Qinghai grass *Poa pratensis* is a cultivar plant cultivated and domesticated from the wild species growing in Dari County at an altitude of 4000 m through many years by the Qinghai Provincial Academy of Animal Husbandry and Veterinary Sciences. In November 2005, it was approved and registered by the National Forage Variety Approval Committee. In 2015, 6,500 mu of Qinghai grass *Poa pratensis* and Qinghai coldland bluegrass seed production base had been built produced 318,600kg

of primitive seed with obvious economic, ecological and social benefits, and having great prospects.

The Qinghai Chinese fescue wild species in Qinghai Province is widely distributed in alpine grassland with an altitude of 2150~4800m in Qinghai Province. It had began to be collecting, cultivating, domesticating and cultivating from 1973 by Qinghai Province pasture breeding farm and the Grassland Research Institute of the Animal Husbandry and Veterinary Science Institute of Qinghai Province. After more than 30 years of mixed selection, cultivation and domestication, it has been cultivated to be an artificially cultivated pasture that is high-yield, stable, and easy to mechanize. It was confirmed by the National Forage Variety Approval Committee (breed registration number 261) in December 2003 that the wild cultivar Qinghai Chinese fescue is in good quality and is one of the fine grass species for remediation and improvement of degraded grassland.

All three kinds of grass species are belong to the local wild species category. After cultivation and domestication, they finally have become local fine forage grass species, and the wide ranges of cultivation are not able to cause the invasion of alien species.

## (2) Selection of grass species in artificial grass planting activities

Oatmeal generally refers to *avena sativa*. There are three kinds of oats commonly found in China: *avena sativa*, naked oats, and wild oats. Oats is one of the eight largest food crops in the world, and it is No.6 in world grain production ranking. Generally, it is suitable for planting in the North Temperate Zone. In China, it is suitable for growing in areas with long sunshine hours, short frost-free period and low temperature. Qinghai Province is very suitable for its cultivation conditions.

This project plans to use early-maturing oat varieties such as Qingyin No.1, Qingyin No.2 and Qinghai444, and the fine bean grass *Vicia sativa* for manual planting grassland construction. Each project household plans to plant 3 mu artificial grassland, a total of 160 households. In total, 2,500 mu of artificial grass is planted once a year, and the operation is carried out by no-till sowing. The seeding amount is 100 kg/hm<sup>2</sup>.

Announcement of No. 477 by the Ministry of Agriculture of the People's

Republic of China, the National Forage Variety Approval Committee of 2003-2004 approved and announce 47 varieties of forage grass and forage crops. See the screenshot for the list.

2003—2004年度全国牧草品种审定委员会

审定通过的牧草和饲料作物品种名录：

| 序号 | 品种名称   | 品种类别 |
|----|--------|------|
| 31 | 青引1号燕麦 | 引进品种 |
| 32 | 青引2号燕麦 | 引进品种 |

Moreover, through the efforts of the oat breeding workers in Qinghai Province, the oats have been improved in the eastern agricultural areas of the province, and the oat varieties have been improved in areas with good hydrothermal conditions in the pastoral areas. The oats that have been approved and registered by the National Forage Variety Approval Committee or the Qinghai Provincial Crop Variety Approval Committee, and have been widely promoted includes: Qingyan No.1, *Avena sativa*, originally from the Zhangbei area of Hebei Province, uniformly numbered as Qingyong 001 in 1975; suitable for use as green forage in the area of above 3400~4200m altitude. Qingyan No. 2, *Avena sativa*, introduced from Canada in 1960, in 1975, unified as Qing 473; suitable for harvesting forage at an altitude of over 3400m. Qinghai 444, *Avena sativa*, native to Denmark, introduced by the Chinese Academy of Agricultural Sciences in 1964, introduced to Qinghai in 1964, and unified in 1975 as Qingchang 444; this variety was promoted in Qinghai in the 1970s due to its cold tolerance and drought resistance. Well, there is still cultivation value in the pastoral areas.

The peas grass *Vicia sativa* is distributed wild in Jiangsu, Jiangxi, Taiwan, Shaanxi, Yunnan, Qinghai and Gansu. Lanzhou University, College of Grassland Agricultural Science and Technology, State Key Laboratory of Grassland Agro-ecosystem, selected the Lanjian series of *Vicia sativa*. The varieties include Lanjian No.1, Lanjian No.2 and Lanjian No.3. It is currently being promoted in provinces and autonomous regions such as Gansu, Qinghai, Sichuan and Tibet. Lanjian No.3 *Vicia sativa* was approved by the National Grass Variety Approval

Committee in 2011. It is the first arrow pea variety in China suitable for cultivation on the Qinghai-Tibet Plateau. It is characterized by short growth period and high grass yield. Lanjian No.1 *Vicia sativa* was approved by the Gansu Provincial Grass Variety Approval Committee in 2014, which is characterized by high grass yield. It is one of the main varieties of Gansu Province. Lanjian No.2 *Vicia sativa* was approved by the National Grass Variety Approval Committee in 2015 and has the characteristics of high grass and seed yield. It is listed as one of the leading varieties of the Ministry of Agriculture in 2016.

The grass species are cultivated and domesticated into local fine forage species, and their cultivation will not cause the invasion of alien species.

### (3) Forage species invaded weeds in Chinese

The forage species that cause weed invasion in China include: water hyacinth, *Alternanthera philoxeroides* (water peanut), *Spartina alterniflora*, *Panicum maximum*, *Axonopus compressus*, *Rhynchlytrum repens*, and *S.sudanense*. There are also pastures that have already exhibited invasive traits: Clover, *M.alba*, *Malvastrum coromandelianum*, *Phleum pretense*, *Aegilops squarrosa*, *Brachiaria erucaefomis*, *P.dilatatum*, *P.fimbriatum*, *Pennisetum setosum*, *Setaria palmifolia*, *L.persicum*, *L. temulentum*, and *Hordeum jubatum*.

The pastures to be planted in this project do not have the above-mentioned forage species.

### (4) Purchase of grass species

In order to avoid the inconsistency of grass seeds quality, or the introduction of weed seeds by unscrupulous merchants, the project purchases high-quality forage seeds through open tendering to control seeds quality to meet the requirements of Grade 3 and above specified in GB 6142. The planting area of the project will supply seeds and will be guided the key steps of technology such as: the plant, management, harvesting and utilization of manual grassland to ensure the supply of high-quality forage materials for the livestock feed of the project.

### (5) Grass species control

The project need to select grassland no-tillage reseeding agricultural companys with a certain scale of qualification, and organize the implementation of no-tillage

reseeding based on the village-level government in the project area.

At present, no-tillage seeding and manual planting grass have been carried out for many years in the project area. There is no invasion of alien species, So there is almost no harm to alien invasion in the project area.

(6) Supervision for the foreign feed (forage) purchase

After many years of the foreign feed (forage) purchase in this region, no damage has been found in the project area, so the risk of alien invasion is very small for the foreign feed (forage) purchase may happen in the project area.

In this project, the nutritional structure and feed composition of the original livestock and the source of the pasture are not changed to avoid the risk of alien invasion.

(7) If found that wild oats are mixed, the wild oat seeds in the seeds can be picked and throw away by Crop rotation, or the wild oats can be germinated by shallow tillage before planting in the oats, then kill the whole grass by chemical herbicides, and then planted.

## **5.2 Impacts of project implementation on ecosystem plant biodiversity and mitigation measures**

### **5.2.1 Impacts of grassland no-tillage reseeding on biodiversity and mitigation measures**

This project will use no-tillage seeding to work on degraded alpine meadow. During the soil thawing period before the spring rainy season, the project will complete the ditching, sowing, covering and suppression of soil at same time, and reseed the excellent herbage, so as to minimize the damage to the native vegetation of degraded meadow. Selecting sows in the group of natural grass is suitable for the growth of the Qilian Mountain perennial gramineous forage grass seed, selection Elymus nutans: Qinghai Chinese fescue: Qinghai grass Poa pratensis 1:1:1. The seeds are depilated before planting to meet the requirements of mechanical sowing,

the seeds amount is 15~20 kg/hm<sup>2</sup>.

#### **5.2.1.1 Literature research analysis**

A similar regional research literature in the project area was used as a reference for analysis. According to the research on the re-seeding of black soil beach in Qinghai Province, the no-tillage reseeding was also adopted, and the replanted grass species were *Elymus nutans*, Qinghai Chinese fescue, Qinghai. The results showed: (1) Re-seeding measures can significantly improve the vegetation coverage of the black soil beach and the aboveground biomass of the grassland. Underground biomass also increased significantly, mainly in the surface layer of the soil. (2) After reseeding, the biomass on the miscellaneous grassland was significantly lower than that before reseeding. It may be that the gramineous grass occupied more nutrients in the soil, thus inhibiting the growth of the weeds. This could significantly reduce the number of species, dominance, and the proportion of toxic plant species in the total number of species in the grassland. (3) The species richness, diversity index and species uniformity change were higher than that of uncultivated grassland, but did not show a significant level. After artificial reseeding, the spatial pattern of the original plant community was changed, which was conducive to the formation of new niche, increasing the species diversity of the community. (4) The effect of artificial re-seeding was better than the separate fencing and enclosure measures. However, long-term artificial reseeding also causes monotony of community species composition and affected the stability of community structure. There were also studies to suggest that species richness decreases rather than the expected increase with recovery time. (5) The diversity index of only Chinese fescue and mixed Chinese fescue and *Elymus nutans* was significantly reduced. The above-ground biomass of the grassland community after reseeding was significantly increased compared with the control. Because the re-seeding gramineous grass had improved the proportion of grassland excellent pasture, which had played a certain role in grassland improvement. So reseeding is an effective measure for the improvement of desertification grassland.

The affecting factors for reseeding and biodiversity are as follows: (1) the principle of reseeding forage grass species selection: the reseeding species has a

decisive effect on the success of reseeded, and species selection is affected by many factors. It is usually selected to adapt to the local natural climatic conditions for re-breeding, which requires short time and quick recovery, and is easy to restore grassland. The grass in the alpine pastoral area should choose cold-tolerant poa crymophila and the replanted grass species have higher germination rate and stronger competitiveness. And for different environmental conditions of the reseeded area, the wild pasture or domesticated cultivation is targeted. When the reseeded, need to select some of the best pastures in the community to avoid compensatory failure due to competition. The purpose of reseeded is mostly based on increasing the yield of fine pasture in grassland, thereby increasing the carrying capacity and reducing the contradiction between grass and livestock. Therefore, we choose grass and legume forage. (2) Determination of the amount of reseeded: the amount of seed is related to the seed size and the degree of degradation, and also to the ecological status of the reseeded species in the grassland. Relatively, the amount of reseeded seed is generally about 20 to 50 kg/hm<sup>2</sup>. Elymus nutans was selected as the main reseeded grass seed with a seeding amount of 25 kg/hm<sup>2</sup>. Studies had found that relatively high seeding rates can reduce the coverage, biomass and species diversity. (3) Re-seeding time: The specific re-seeding time is generally based on the local climatic conditions. The spring period is generally from the end of April to the beginning of May.

#### **5.2.1.2 Analysis of the impact of no-tillage reseeded grassland activities on biodiversity in Qilian County**

The study began in 2015 on degraded grassland in Wariga Village, Moeller Town, Qilian County, Qinghai Province. The grass seed for reseeded is Elymus nutans, Qinghai Chinese fescue, Qinghai grass Poa pratensis, which were mixed at 1:1:1, and the seeding amount is about 3~4kg/mu; the treatment was to carry out grazing and reseeded in the regreening period. The comparison was not to carry out grazing and reseeded. The grassland of the typical alpine meadow, grassland meadow and swamp meadow was selected for the rest period. The effects of reseeded and grazing on vegetation restoration status were evaluated by measuring vegetation height, coverage and biomass. The converted seeding amount was about

3~4kg/mu, which is 45~60kg/hm<sup>2</sup>, which is three times of the planned seeding amount of this project.

(1) Effects of no-tillage reseeding + forbidden grazing in the regreening period on the important value of grassland plants.

Important values indicate the ability of the species to function in the community. If the plant population has a greater value, it indicates a higher status in the community. No-tillage reseeding + forbidden grazing in the regreening period, the important value of grasses in alpine meadows was increased, and the important value of *Poa pratensis* increased by 3.44%. The total value of Cyperaceae increased from 26.95% to 27.23%. The total important value of broadleaf weeds decreased from 40.00% to 25.16%. The important value of grassland meadows has changed. The important value of *Festuca rubra* increased by 3.70%; the important value of weeds decreased as a whole, and the important value of dwarf velvet grass represented by broadleaf weed decreased by 2.67%.

(2) Effects of no-tillage reseeding + forbidden grazing in the regreening period on grassland biodiversity

After the no-tillage reseeding + forbidden grazing in the regreening period, the biodiversity index of alpine meadow community changed to some extent. Seeing Table 5-1, the species richness and Shannon-Wiener index increased significantly ( $P < 0.05$ ). The Pielou index gradually rises, as shown in Table 5-2. It showed that no-tillage reseeding + forbidden grazing in the regreening period showed the grassland community species distribution more uniform, which is conducive to the benign succession of grassland.

The richness of grassland meadow community increased, but the Pielou index increased gradually, while the Simpson diversity index decreased, indicated that the grasses and sedges gradually became dominant in the community after no-tillage reseeding + forbidden grazing, grassland species increased, species distribution in grassland and grassland was more uniform, making the community more stable.

Table5-1 Plant species composition and important value of different grassland types

| Species                       | CK    | no-tillage reseeding + forbidden grazing in the regreening period |
|-------------------------------|-------|---|
| <i>Elymus nutans</i>          | 18.47 | 29.59   |
| <i>Poa crymophila</i>         | 14.58 | 18.02   |
| <i>Kobresia pygmaea</i>       | 13.97 | 14.08   |
| <i>Kobresia humilis</i>       | 12.98 | 13.15   |
| <i>Oxytropis ochrocephala</i> | 8.86  | 4.86  |
| <i>Leontopodium nanum</i>     | 3.89  | 2.44  |
| <i>Potentilla nivea</i>       | 4.98  | 3.63  |
| <i>Pedicularis kansuensis</i> | 2.94  | 1.76  |
| <i>Thalictrum alpinum</i>     | 2.09  | 1.62  |
| <i>Plantago asiatica</i>      | 2.79  | 1.55  |
| <i>Gentianella azurea</i>     | 1.54  | 1.26  |
| <i>Saussurea pulchra</i>      | 3.96  | 2.15  |
| <i>Gentiana szechenyii</i>    | 1.26  | 0.53  |
| <i>Cirsium souliei</i>        | 0.28  | 0.24  |
| <i>Plantago asiatica</i>      | 1.58  | 0.63  |
| <i>Taraxacum platyepidum</i>  | 1.84  | 1.03  |
| <i>Ranunculus tanguticus</i>  | 0.73  | 0.52  |
| <i>Lagotis brachystachya</i>  | -     | 0.14  |
| <i>Astragalus fenzelianus</i> | -     | 0.72  |
| <i>Ajuga lupulina</i>         | 1.78  | 1.03  |
| <i>Potentilla multifida</i>   | 1.48  | 1.05  |

Table 5-2 Diversity index of different grassland types

| Grass type       | Treatment                   | Species richness | Shannon-Wiener | Pielou      | Simpson diversity |
|------------------|-----------------------------|------------------|----------------|-------------|-------------------|
| Alpine meadow    | CK                          | 20.35±1.44b      | 2.519±0.02b    | 0.817±0.01a | 0.894±0.01b       |
|                  | seeding + forbidden grazing | 22.86±1.53a      | 2.634±0.01a    | 0.876±0.01b | 0.823±0.01a       |
| Glassland meadow | CK                          | 24.25±1.44a      | 2.637±0.02a    | 0.791±0.01b | 0.922±0.01a       |
|                  | seeding + forbidden grazing | 24.86±1.53a      | 2.649±0.01a    | 0.823±0.01a | 0.875±0.01b       |

The reseeding grass species used in this project belong to the local excellent perennial grass of gramineae. Similar to the related research projects, the species distribution and biomass of the reseeding grass should be monitored and assessed. Proper grazing is to avoid the dominant growth of gramineae grass and to reduce the richness of grass species (except poisonous weeds).

In order to protect the biodiversity of grassland ecosystem, it is suggested to

adopt the appropriate amount of reseeded according to different grassland degradation situations to protect grassland biodiversity. With the environmental monitoring management plan, need to monitor regularly biodiversity on the reseeded grassland.

### **5.2.2 Impacts of manual planting grass on biodiversity of project area and mitigation measures**

The project uses livestock sleeping circle for the manual planting grass, its present situation is the growth weed, and the grass quantity production capacity is low. To choose tall Qingyin no.1, no. 2, Qinghai 444, precocious oat and Vicia sativa for manual planting grass, established stable, high-yield manual planting grassland.

In this project, no-till is adopted for seeding. The seeding rate is 100 kg/hm<sup>2</sup>, and the sowing depth is 3-4 cm. The seeding method is a drilling tillage. Sowing time is in mid-May. After the broadcast, repression is carried out to ensure that the sputum and the emergence are neat. In the autumn, castration is used to prepare hay and storage for high-quality forage for livestock feeding.

Manual planting grass can reduce the biodiversity of grasslands, but the project is planted with annual grasses. The local livestock sleeping circle is the pasture supplied by herdsmen, which is allowed to grow herbage to support animals. The land should belong to cultivated land, and the cultivated land of per household is only 2~3 mu, which is relatively small, so it has little impact on the biodiversity of grassland.

According to the World Bank EHS guidelines on Environmental, Health and Safety for Annual Agricultural Products, the following measures should be taken to protect agricultural biodiversity for the impact of biodiversity:

If possible, reuse the stubble of the early crop on the surface of the soil as much as possible. The potential transmission of pests and diseases should be considered before implementing this approach.

- Reduce land leveling to maintain soil ecosystem structure;
- Take the boundary around the annual crop production land as the wild

plants growth area;

- Certified crop seeds should be used, which should not contain exogenous invasive varieties, and their diameter, variety, package should be consistent with the information;
- In order to accommodate pest predators, it ensures a favorable habitat for them, such as hedges, nesting sites, primary vegetation and so on;
- In the case of crop harvesting or collection, the interference to the surrounding areas shall be minimized.

With the environmental monitoring management plan, need to monitor regularly biodiversity on the reseeded grassland.

### **5.2.3 Effects of pest control on biodiversity in project areas**

The project combines artificial killing and biological control, popularizes biological control technology and comprehensive technology and reduces the loss to the range of ecological threshold.

#### **(1) D-type Clostridium botulinum toxin**

The pesticide used in rodent control is D-type bio-poisonous toxin. D-type Clostridium botulinum toxin (U Hazard Class) is one of the neuropalatinic toxins and has proteolytic activity. After oral intake and intestinal absorption, the rodent acted on cranio-cerebral nerve, peripheral nerve and muscle junction and vegetative nerve endings, hindering the release of acetylcholine, causing muscle paralysis and causing paralysis of motor nerve endings, and the rats died within 3 to 7 days after swallowing. D-type Clostridium botulinum toxin is not only good for the control of plateau pika, but also does not harm the natural enemies of rats. The dead rats were foraged by hawks and Tibetan foxes, and no poisoning was observed. It has the advantages of strong toxicity, low dosage, low cost, good palatability, quick effect, and no pollution to the environment, safety to humans and animals, and convenient use.

Therefore, these two biological rodenticides have little impact on the biodiversity for the project area.

(2) Caterpillar control uses 1.2% nicotine and matrine as insecticides

After spraying, once the insect touches the drug, it paralyzes the nerve center, then coagulates the protein of the insect body, blockages the stomata of the insect body, and suffocates the insect to death.

1.2% nicotine·matrine (U Hazard Class) as a pesticide, is a plant-derived pesticide. The main active ingredients are matrine and nicotine. It belongs to the pyridine derivative alkaloid. It is characterized by high efficiency, low toxicity, low residue, no pollution, and safe use. After 7 days, the residual amount in different crops and soils is lower than the national standard, so there is no residue problem. It has low dosage, is easily degraded in the environment, and can be rapidly decomposed in nature. The final product is carbon dioxide and water, and it has no pollution to the environment.

Therefore, the pesticide has no significant impact on biodiversity.

Based on the principle of obvious effect on target species and little impact on non-target species and environment, pesticides used in the project area can protect the biodiversity of the project area and maintain ecological balance by using biological control and integrated biological control technology. It is suggested to conduct monitoring according to pest management plan and management according to monitoring results.

### **5.3 Impact of project implementation on ecosystem animal biodiversity and mitigation measures**

In Qilian Mountain National Park Reserve, there are many kinds of wild animals, including more than 20 species such as wild yaks, wild donkeys, white-lipped deers, snow leopards and bears.

As shown in the 4.1 project location, the project area is not within the protected area, and the project activities will not affect wildlife. During the investigation, the herdsmen reported that there were some wild animals in the mountain protection area. When the food is shortage, the wild animals would occasionally go down to herdsmen's pasture to forage. Most of them are wolves, which caused losses to the

herdsmen's livestock in the project area. All herdsmen know that wildlife should be protected, and the forest public security and insurance compensate for the casualties of wildlife in pastoral areas when herdsmen's livestock are killed or injured by wild animals.

# Chapter 6 Alternative option analysis

The alternative option analysis aims to optimize the project design from the social and environmental factors, compare and analyze the scope of impact and degree of different design on the ecological environment, recommend the optimization option from the perspective of environmental protection when the project is going to implement, and provide scientific decision basis. General principles of alternative analysis are as follows:

- The principle of quantitative comparison: quantify the environmental impact of project implementation as much as possible for each alternative option.
- The principle of comprehensive comparison: make a comprehensive comparison and analysis from the factors of environment, technology, economy, society and so on.

## 6.1 Comparison of implementing the projects or not

The analysis of the comparison of implementing projects or not are summarized in table6-1.

Table 6-1 the analysis of the comparison of implementing projects or not

| Category        | Implement the project   | Not implement the project<br>(zero project)   |
|-----------------|---|---|
| Main advantages | The project is designed to carry out the demonstration and promotion of new technologies in the whole chain of grassland improvement grassland plant production and diversity protection herbivorous livestock production in grassland ecosystem, the project will be designed to pilot the technology demonstration of climate-smart and herder involved grassland ecosystem management in alpine grassland, and pilot research will be carried out on evidence based ecological compensation policy, to improve grassland productivity and grass and animal husbandry production efficiency and increase the income of farmers and herders; at the same time, to protect grassland biodiversity, and improve ecological service functions such as carbon sequestration and mitigation in grassland, realize the coordinated development of the human - grass - livestock system; carry out activities such as innovation and application of relevant supporting policies, expansion and promotion of public knowledge, and establish a climate smart grassland ecosystem management system through technology demonstration and application, policy innovation and new knowledge popularization, enhance the adaptability of grassland production to climate change, and improve carbon sequestration and | The status of the project is maintained. For example, vegetation is not be destroyed. There is no environmental impact such as construction noise, waste gas, waste water and solid waste caused by infrastructure facilities in the construction period. |

|                           |  |   |
|---------------------------|--|---|
|                           | <p>mitigation capacity of grassland system in China. By carrying out activities such as innovation and application of relevant supporting policies, expansion and improvement of public knowledge, it would establish a climate-smart grassland ecosystem management system, enhance the adaptability of grassland production in the project area to climate change and enhance the carbon sequestration and emission reduction capacity of grassland system.</p> <p>In order to improve the quality of grassland and improve the capacity of livestock per unit area of grassland, the project is going to implement no-tillage reseeded. Protect the grassland and improve the efficiency of animal husbandry by Spring-forbidden grazing and change the grazing habit of herdsmen. The manual planting grass supplements to regulate the nutrition of livestock and provide nutritive and reasonable forage for forbidden grazing period, in order to reduce the carrying capacity of livestock in the pasture and improve the quality of the pasture. It could prevent and control pests and rats comprehensively.</p> <p>The goal is to increase grassland productivity by 20%-30% in the project area. The biodiversity of grassland is to be maintained through the regulation of seasonal forbidden grazing and grazing pressure. The efficiency of livestock production can be increased by 30% and the income of herdsmen can be increased by 10%-15%. Manual planting grass can ensure the supply of forage in non-growing seasons and improve the ability of grass husbandry to resist natural disasters and climate change.</p> |   |
| <p>Main disadvantages</p> | <p>Manual planting grass will reduce the biodiversity in small areas;<br/>The project implementation period will destroy vegetation, disturb the land, and have dust, noise, solid waste and other influences on the surrounding environment.</p>  | <p>The habitat of Qilian Mountain is fragile. At the same time, under the influence of overgrazing and rampant rodent damage, the grassland in the area has been seriously degraded. The grassland degradation has led to the decline of the height and coverage of herbage in the community and the decrease of edible herbage. The stocking capacity of grassland decreased, which seriously restricted the development of animal husbandry in the area.</p> <p>The contradictory balance of grass and livestock, herdsmen's income increased difficultly. Due to the small area of artificial forage land in Qilian County, it is still difficult to solve the contradiction between grass and livestock, which affects the income growth of farmers and herdsmen.</p> <p>After the implementation of the forbidden grazing and the balance of grass-livestock, the reduction of livestock is mainly based on semi-feeding and</p> |

|  |  |  |
|--|--|--|
|  |  | <p>feeding. The fund is low so that it is not enough to purchase the forage for the livestock. It is necessary to raise the grassland subsidy standard to meet the supply and reserves of forage grass. The effect of pest control on grassland is not satisfactory. There is a large area of severely degraded grassland in Qilian County that cannot be effectively utilized. The problem of pest diseases in degraded grassland is still serious. The grassland management and auditors need to upgrade their professional skills.</p> <p>The technical supervision of grassland supervision institutions in Qilian County and Qilian Township is weak. The grassland area in the county is vast and the grassland supervision and patrol work is large. It is necessary to increase the supporting fund of projects and optimize the grassland management mode, in order to improve the efficiency of grassland management and inspection.</p> |
|--|--|--|

From the table, although there is no environmental impact problem without project implementation, but the grassland in the area has been seriously degraded in the project area of Qilian County, has seriously restricted the development of animal husbandry. The ecological environment of the region is generally deteriorating: the lower limit of forest line back off, serious soil erosion, serious grassland degradation, poisonous weeds overflow, and rats rampant. Wetlands are reducing, snow line is rising, and land desertification is expanding. Due to the grassland ecology fragile, over grazing, the grassland vegetation is rapidly degraded and desertification. Although the implementation of the project will bring some environmental impacts, these impacts can be avoided and reduced by adopting corresponding environmental protection measures. Moreover, the environmental impacts of the implementation period are temporary, while the social and environmental benefits brought by the project implementation and operation are long-term. Therefore, from the perspective of promoting social and economic development and protecting the environment, the implementation of the project option is better than the not, it is necessary to implement this project.

## 6.2 Comparison of alternatives to project activities

According to the feasibility study report, comparative analysis was made on the reseeded, manual planting grass and implementation location site in the project activities. The analysis is shown in table 6-2.

Table 6-2 List of necessary analysis for project activities

| Comparison content            |  | Option 1   | Option 2  | Optimization  |
|-------------------------------|--|--|---|---|
| Reseeding grass species       | Environmental adaptability of grass species combinations | Elymus nutans, Qinghai Chinese fescue, Qinghai grass Poa pratensis, these three grass species mixed in a 1:1:1 ratio for reseeding. Qinghai grass Poa pratensis is not only highly resistant, and also has long green period, rich leaf quantity, good palatability, good rhizome and strong grazing resistance, which is suitable for vegetation restoration and improvement of degraded grassland. | Elymus nutans, Qinghai Chinese fescue, Poa crymophila, these three grass species mixed in 1:1:1 ratio for reseeding.  | Option 1 is better  |
|                               | Quantity of Reseeding                                    | The seeding amount is 15~20 kg/hm <sup>2</sup> . It is found that relatively more seeding amount can reduce the weeds coverage, species diversity.   | When the seeding amount is 45~60kg/hm <sup>2</sup> , has a good effect on re-seeding and restoration of degraded grassland in the project area. The species richness and Shannon-wiener increase significantly. Pielou increased, the number of species increased and the distribution of species in the grassland is more uniform. It makes the community more stable. | Option 1 is better<br>According to degradation situation, in the serious degradation grassland or more weeds could use Option 2 |
| Manual planting grass species | Environmental adaptability                               | All four grass species are the same  | All four grass species are the same   | -   |
|                               | Fresh grass production (t/hm <sup>2</sup> )              | Qinghai 444: 22.25.<br>Qingyin 2: 16.18.<br>Qingyin 1: 15.9.   | Qingyin 2 + Vicia sativa mixed seeding: 57.36. Qingyin 1 + Vicia sativa mixed seeding: 51.70. Qinghai 444 + Vicia sativa mixed seeding: 37.0.   | Option 2 is better  |
|                               | Seed production (kg/hm <sup>2</sup> )                    | Qinghai 444: 3633.14. Qingyin 1: 2526.47. Qingyin 2: 2270.98   |   |   |
|                               | Aggregation indicator                                    | Qingyin 1 > Qinghai 44 > Qingyin 2   |   |   |
|                               | Resistance to aphids                                     | high-resistance varieties: Qinghai 444.<br>Qingyin 1、Qingyin 2 are Insect-susceptible varieties  |   |   |
|                               | Economic benefits  | The seed price of Qingyin 1、Qinghai 444、Qingyin 2 are almost same. The economic benefits is only related to grass production   |   |   |
| society                       | Project implementer selection                            | For project implementation, 160 households were randomly selected as project intervention households.  | In order to make the activities relatively concentrated and contiguous, the herdsmen connected with the grasslands are bound together as units for random selection, so as to ensure the relative contiguous and implementation effect of the activities.   | Option 2 is better  |

Overall, reseeding grass species select Elymus nutans, Qinghai Chinese fescue, Qinghai grass Poa pratensis, these three grass species mixed in a 1:1:1 ratio. They are suitable for vegetation restoration and improvement of degraded grassland.

The amount of seeding is suggested 15~20 kg/hm<sup>2</sup>. The amount of seeding is suggested 45~60kg/ hm<sup>2</sup> in the serious degradation grassland or more weeds. For manual planting grass species, oats and *Vicia sativa* mixed seeding have the best benefits, the production is better than Single-seeded oats. In order to make the activities relatively concentrated and contiguous, the herdsman connected with the grasslands are bound together as units for random selection, so as to ensure the relative contiguous and implementation effect of the activities.

# Chapter 7 Public Participation

## 7.1 Purpose and method

The public participation in environmental impact assessment, is a method to know the attitudes and opinions in groups of all social strata and the public for construction projects, meanwhile is an opportunity to participate in the construction project environmental impact assessment, so the public participation in environmental impact assessment of construction project should be more democratic and in public, in order to avoid one-sided decision, bring difficulties and resistance to later work. “The environmental impact assessment law of the People's Republic of China” and the World Bank Regulations, the environmental impact assessment of projects have to listen to the opinions of the surrounding people.

(1) Let the public understand the purpose, scale, construction location of the project, the possible pollution to the surrounding environment and the proposed prevention and control measures during the construction and operation time, and let the public express their opinions, and finally get understanding, support and cooperation.

(2) By asking local long-term residents for the results of their personal experience and intuitive feelings about their place of residence and living environment, it can assist to analyze the current quality and level of various environmental elements in the region, so as to reflect the objective degree of environmental impact assessment and protect the vital interests of the public.

Public participation in this EIA is mainly through visiting, the information open, announcement and social survey. Through visiting and announcement, the public can understand the general situation of this project and collect all kinds of information from interviews, questionnaires and other. The commonly used methods are quantitative investigation and semi-quantitative investigation. Quantitative survey can obtain highly accurate statistical data, usually using questionnaire; Semi-quantitative investigation can be informal. Social surveys can provide a comprehensive and in-depth understanding of the environmental and economic impact of the area in question.

## 7.2 Identification of stakeholders

Focus on the evaluation area of the relevant government departments, competent departments, relevant experts, project area herdsman for public consultation. For the identified stakeholders, understanding their thoughts, opinions and suggestions; after the public consultation activities, all the questions found and all the opinions collected should be summarized, and the answers (or results) should be informed to the relevant stakeholders.

The content and process description of these activities and the content of public participation in the editorial report should be summarized in the environmental impact assessment report, and the relevant content of the social management plan should be incorporated into the environmental management plan.

The project stakeholders include the following organizations. Specific identification conditions are shown in table 7-1.

Table 7-1 List of major stakeholders of the project

| Serial | The project name                          |   | Stakeholders                                |   |
|--------|---|---|---|---|
|        |   |   | Affected population                         | Relevant departments and experts  |
| 1.1    | Natural grassland management              | No-tillage seeding at degraded grassland  | Project households herdsman in Moeller town | County government, Moeller town people's government, Forestry bureau, Grassland Supervision Station                                     |
|        |   | Spring forbidden grazing  | Herders in Moeller town                     | County government, Moeller town people's government, Forestry bureau, Grassland Supervision Station                                     |
|        |   | Repairing fence   | Project households herdsman in Moeller town | County government, Moeller town people's government, Forestry bureau, Grassland Supervision Station and Environmental protection bureau |
|        |   | Rodents and pests control   | Herders in Moeller town                     | County government, Moeller town people's government, Forestry bureau, Grassland Supervision Station                                     |
| 1.2    | Cultivated grassland management           | Manual planting grass in livestock sleeping circle                                      | Project households herdsman in Moeller town | County government, Moeller town people's government, Forestry bureau, Grassland Supervision Station                                     |
| 1.3    | Livestock nutrition regulation management | Tibetan sheep, yak high-efficiency breeding technology key technology promotion subsidy | Project households herdsman in Moeller town | County government, Moeller town people's government, Environmental protection bureau, Husbandry bureau, County veterinary station       |
| 1.4    | Technical training and services           | Technical consultation and guidance in the project area                                 | Herders in Moeller town                     | County government, Moeller town people's government, Forestry bureau, Grassland Supervision Station,                                    |
|        |   | Construction of village   | Herders in Moeller town                     | County veterinary station,  |

|  |  |                           |   |                                 |
|--|--|---------------------------|---|---------------------------------|
|  |  | Construction of village   | County and village three - level farming and animal husbandry technology and management personnel | Environmental protection bureau |
|  |  | Herdsman on-site teaching | Herders in Moeller town   |                                 |

### 7.3 Procedures and contents

Public participation includes 2 stages: one is in the preparation stage of the project, and the other is in the feasibility stage. The purpose of the first stage of public consultation and information open is let the public and stakeholders to understand project, and the degree of understanding, and their attitude for the project about the environmental and social impact. The main purpose of the second stage of public consultation and information open is to tell the stakeholders about the activities designed, its potential environmental impacts, and the measures mitigate, to get the public acceptance level, and to inform the public the channels for complaints about the environmental issues.

To carry out public consultation and information open activities, the materials about project should be submitted to the affected groups and individuals in advance. Its form and language should be easy to understand. Keeping the record of the consultation process, the record should be written the mode of consultation (e.g., survey), date and place of the meeting, the list of participants and their affiliated units and contact addresses, comments and feedback from the public, and summary of the public consultation.

### 7.4 Ways and contents of public participation

Public participation in the project is carried out in two stages.

#### 7.4.1 Preparation stage of feasibility study

In this stage, carry out the first public participation by colloquia, include: experts and local department leaders, and project area farmers, to collect opinion. Time, place and participants are shown in Table 7-2.

Table 7-2 Summary of forms of public participation

| Date      | Place                                | Forms of public participation | Participants  |
|-----------|--------------------------------------|-------------------------------|---|
| 2018.7.13 | Xining Agriculture and pastoral hall | Colloquia                     | World Bank experts and expert group, Agriculture and pastoral leaders   |
| 2018.7.14 | Qilian County government             | Colloquia                     | World Bank experts and expert group, County leaders and related staff   |
| 2018.7.14 | A rou town, Qilian county            | Site investigation            | World Bank experts and expert group, village secretary, herdsmen of Qing Yanggou village and Bai Shiya village                                      |
| 2018.7.15 | Qilian county Yeniugou township      | Site investigation            | World Bank experts and expert group, farmers of Dalang village and Daquan village, and managers of “black earth beach”                              |
| 2018.7.16 | Moeller town, Qilian county          | Site investigation            | World Bank experts and expert group, Town government staff, village secretary, Kersh beach administrator, villagers of Vahriga and Caishitu village |

The Colloquia was conducted by MOA, PMO and expert group to introduce the main implementation content of the project for the relevant departments of the local government and answer the question about the projects, financial allocation and use principle. The project area leaders welcome the projects implementation, the relevant responsibility expressed actively cooperate with the data preparation and project design implementation activities. The colloquia mainly discussed about the feasibility of project implementation contents, and suggestion.

Environment evaluation and social evaluation experts discussed with the project area village header and the representatives, they were actively participating in the discussion, the main labors, women and old people also participate actively in discussions, and knowed the herdsmen problems in their practice and the related needs. After experts introduced this project, the villagers said this is a good thing, can solve the problem for them, and they were willing to participate in the project. During the discussion, mainly understood about the climate and the development status of husbandry, the epidemic prevention problems in livestock breeding and grassland management, the conditions about water conservancy facilities and related infrastructure construction in the project area, and there are any wild animals and the livestock loss and so on.

Suggestion summary is following:

(1)The households in the project area hope to participate in the project enthusiastically, and promote the implementation of the project as soon as possible, and hope the project benefits to the households.

(2)The main problems of farmers in production are: the rodent and pests problem are serious in the project area; inadequate numbers of staff, lack of technical personnel and relevant training, lack of personal protective goods; a dearth of infrastructure, low utilization rate of greenhouse, low forage yield, lack of processing machinery and other ancillary

facilities; the Storage tanks freeze in winter.

(3)The most of population in the project areas are ethnic minorities.

(4) Wild animals near the project area occasionally go to the pastoral area to hunt and breed livestock, most of which are caused by wolves.The livestock loss caused by wildlife will be compensated by forest public security and insurance together, but the compensation price is still lower than the market price.

(5)Farmers in the project area have a strong ability to accept advanced technologies, and some farmers have rich planting experience, which can ensure the implementation of the project.

According to project area farmers' demands and concerns, the project carries out the relevant design:

(1)The goal is to increase grassland productivity by 20%~30% in the project area. The biodiversity of grassland is to be maintained through the regulation of seasonal forbidden grazing and grazing pressure. The efficiency of livestock production can be increased by 30% and the income of herdsman can be increased by 10%~15%. Manual planting grass can ensure the supply of forage in non-growing seasons and improve the ability of grass husbandry to resist natural disasters and climate change.

(2)Manual planting grass can ensure the supply of forage in non-growing seasons and improve the ability of grass husbandry to resist natural disasters and climate change. Manual planting grass can also full use the livestock manure as organic fertilizer, avoiding the use of chemical fertilizers.

(3)Improve the production and management level of herdsman's grass husbandry through technical services and training.

(4)Realize the coordinated development of the human - grass - livestock system; carry out activities such as innovation and application of relevant supporting policies, expansion and promotion of public knowledge, and establish a climate smart grassland ecosystem management system through technology demonstration and application, policy innovation and new knowledge popularization, enhance the adaptability of grassland production to climate change, and improve carbon sequestration and mitigation capacity of grassland system in China.

(5)In order to improve the quality of grassland and improve the capacity of livestock per unit area of grassland, the project is going to implement no-tillage reseeding. Protect the grassland and improve the efficiency of animal husbandry by Spring-forbidden grazing and change the grazing habit of herdsman. The manual planting grass supplements to regulate the nutrition of livestock and provide nutritive and reasonable forage for forbidden grazing period, in order to reduce the carrying capacity of livestock in the pasture and improve the

quality of the pasture. It could prevent and control pests and rats comprehensively.

The photos of Colloquia and field survey are shown in Figure 7-1, 7-2. The sign form to participants is shown in Figure 7-3.



Figure 7-1 Survey of Qinghai project area



Figure 7-2 Investigation of Gansu province

0718 岳和强

| 序号 | 姓名  | 单位  | 职务/职称 | 联系方式        | 签字 |
|----|-----|-----|-------|-------------|----|
| 27 | 李长  | 徐家湾 | 村长    | 11719118819 |    |
| 28 | 张德  | 木匠  | 农民    | 15397206581 |    |
| 29 | 史永成 | 岳和强 | 村长    | 15201182988 |    |
| 30 | 张德  | 岳和强 | 村长    | 1837706620  |    |
| 31 | 李长  | 岳和强 | 村长    | 15201182988 |    |
| 32 | 李长  | 岳和强 | 村长    | 15201182988 |    |
| 33 | 李长  | 岳和强 | 村长    | 15201182988 |    |
| 34 | 李长  | 岳和强 | 村长    | 15201182988 |    |
| 35 | 李长  | 岳和强 | 村长    | 15201182988 |    |
| 36 | 李长  | 岳和强 | 村长    | 15201182988 |    |
| 37 | 李长  | 岳和强 | 村长    | 15201182988 |    |
| 38 | 李长  | 岳和强 | 村长    | 15201182988 |    |
| 39 | 李长  | 岳和强 | 村长    | 15201182988 |    |
| 40 | 李长  | 岳和强 | 村长    | 15201182988 |    |

0717 曹和强

| 序号 | 姓名  | 单位  | 职务/职称 | 联系方式        | 签字 |
|----|-----|-----|-------|-------------|----|
| 27 | 李长  | 曹家湾 | 村长    | 1837216124  |    |
| 28 | 张德  | 曹家湾 | 农民    | 1837216124  |    |
| 29 | 史永成 | 曹家湾 | 村长    | 15201182988 |    |
| 30 | 张德  | 曹家湾 | 村长    | 1837706620  |    |
| 31 | 李长  | 曹家湾 | 村长    | 15201182988 |    |
| 32 | 李长  | 曹家湾 | 村长    | 15201182988 |    |
| 33 | 李长  | 曹家湾 | 村长    | 15201182988 |    |
| 34 | 李长  | 曹家湾 | 村长    | 15201182988 |    |
| 35 | 李长  | 曹家湾 | 村长    | 15201182988 |    |
| 36 | 李长  | 曹家湾 | 村长    | 15201182988 |    |
| 37 | 李长  | 曹家湾 | 村长    | 15201182988 |    |
| 38 | 李长  | 曹家湾 | 村长    | 15201182988 |    |
| 39 | 李长  | 曹家湾 | 村长    | 15201182988 |    |
| 40 | 李长  | 曹家湾 | 村长    | 15201182988 |    |

岳和强

| 序号 | 姓名  | 单位     | 职务/职称 | 联系方式        | 签字 |
|----|-----|--------|-------|-------------|----|
| 1  | 徐和强 | 岳和强村委会 | 村主任   | 15201182988 |    |
| 2  | 张德  | 岳和强村委会 | 村民    | 15201182988 |    |
| 3  | 史永成 | 岳和强村委会 | 村长    | 15201182988 |    |
| 4  | 张德  | 岳和强村委会 | 村长    | 15201182988 |    |
| 5  | 李长  | 岳和强村委会 | 村长    | 15201182988 |    |
| 6  | 李长  | 岳和强村委会 | 村长    | 15201182988 |    |
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| 12 | 李长  | 岳和强村委会 | 村长    | 15201182988 |    |

曹和强

| 序号 | 姓名  | 单位     | 职务/职称 | 联系方式        | 签字 |
|----|-----|--------|-------|-------------|----|
| 1  | 徐和强 | 曹家湾村委会 | 村主任   | 15201182988 |    |
| 2  | 张德  | 曹家湾村委会 | 村民    | 15201182988 |    |
| 3  | 史永成 | 曹家湾村委会 | 村长    | 15201182988 |    |
| 4  | 张德  | 曹家湾村委会 | 村长    | 15201182988 |    |
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| 12 | 李长  | 曹家湾村委会 | 村长    | 15201182988 |    |
| 13 | 李长  | 曹家湾村委会 | 村长    | 15201182988 |    |

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|----|-----|--------|-------|-------------|----|
| 13 | 李长  | 岳和强村委会 | 村长    | 15201182988 |    |
| 14 | 张德  | 岳和强村委会 | 村民    | 15201182988 |    |
| 15 | 史永成 | 岳和强村委会 | 村长    | 15201182988 |    |
| 16 | 张德  | 岳和强村委会 | 村长    | 15201182988 |    |
| 17 | 李长  | 岳和强村委会 | 村长    | 15201182988 |    |
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| 19 | 李长  | 岳和强村委会 | 村长    | 15201182988 |    |
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| 25 | 李长  | 岳和强村委会 | 村长    | 15201182988 |    |
| 26 | 李长  | 岳和强村委会 | 村长    | 15201182988 |    |

0717 曹和强

| 序号 | 姓名  | 单位     | 职务/职称 | 联系方式        | 签字 |
|----|-----|--------|-------|-------------|----|
| 1  | 徐和强 | 曹家湾村委会 | 村主任   | 15201182988 |    |
| 2  | 张德  | 曹家湾村委会 | 村民    | 15201182988 |    |
| 3  | 史永成 | 曹家湾村委会 | 村长    | 15201182988 |    |
| 4  | 张德  | 曹家湾村委会 | 村长    | 15201182988 |    |
| 5  | 李长  | 曹家湾村委会 | 村长    | 15201182988 |    |
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| 11 | 李长  | 曹家湾村委会 | 村长    | 15201182988 |    |
| 12 | 李长  | 曹家湾村委会 | 村长    | 15201182988 |    |

0717 曹和强

| 序号 | 姓名  | 单位     | 职务/职称 | 联系方式        | 签字 |
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| 14 | 张德  | 曹家湾村委会 | 村民    | 15201182988 |    |
| 15 | 史永成 | 曹家湾村委会 | 村长    | 15201182988 |    |
| 16 | 张德  | 曹家湾村委会 | 村长    | 15201182988 |    |
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| 25 | 李长  | 曹家湾村委会 | 村长    | 15201182988 |    |
| 26 | 李长  | 曹家湾村委会 | 村长    | 15201182988 |    |

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| 序号 | 姓名  | 单位     | 职务/职称 | 联系方式        | 签字 |
|----|-----|--------|-------|-------------|----|
| 27 | 李长  | 曹家湾村委会 | 村长    | 15201182988 |    |
| 28 | 张德  | 曹家湾村委会 | 村民    | 15201182988 |    |
| 29 | 史永成 | 曹家湾村委会 | 村长    | 15201182988 |    |
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| 40 | 李长  | 曹家湾村委会 | 村长    | 15201182988 |    |

Figure 7-3 sign form

7.4.2 Project feasibility stage

Including 3 types public participation

7.4.2.1 Relevant competent departments of the project area and local expert's consultation

The environmental impact assessment consulted the competent authorities of the project area on the design and environmental related issues of the feasibility study. The personnel and time of consultation are shown in Table 7-3.

Table 7-3 Personnel list for consultation on climate-smart grassland ecosystem management project

| Name            | Work                                    | Position and title                           | Consulting way | Consulting time | Consulting site             |
|-----------------|---|--|----------------|-----------------|-----------------------------|
| Ma Jinyun       | County Agriculture and Husbandry Bureau | Agricultural technology extension researcher | WeChat         | 2019.6.18       | Qilian County               |
| Ma Shoufu       | County grass Supervision station        | Vice Station Master                          | Phone          | 2019.6.17       | Qilian county               |
| Za Xita         | County veterinary station               | Vice Station Master                          | Phone          | 2019.6.17       | Qilian county               |
| Li Zhaxicairang | The people's government of Moeller      | Vice Mayor                                   | WeChat         | 2019.6.17       | Moeller town, Qilian county |

For the implementation of climate-smart grassland ecological management project, the opinions of consulting competent departments are summarized in Table 7-4.

Table 7-4 Summary of Suggestions from public participation consultation authorities

| Question of consultation  | Summary of recommendations   | Design solution for feasibility study   |
|---|--|---|
| What impacts will the project have on local biodiversity conservation? Recommendations for biodiversity conservation in project areas                   | As long as the project is earnestly implemented, it will certainly have a positive impact on biodiversity. As long as the project design is reasonable, the operation is simple and easy, and the project users are willing to accept, the theoretical benefits will certainly become a reality.     | Based on this principle, feasibility study carried out relevant design and activities.  |
| Are there any invasive species in the project area? For example, will the foreign feed (forage) purchase bring Invasive alien species, pests diseases?  | No invasive alien species have been found in the project area, even in whole County. The implementation of herbage planting projects will have to go through strict project review procedures. Herbage seeds need to also be tested, and there should be no obvious pests and diseases.              | This project started the review process, and the source of forage seeds was strictly tested, as shown in EMP  |
| What are your thoughts or suggestions on the project of no-till reseeding and manual planting grass? Any Suggestions on the selection of grass species? | No-till reseeding is good, as long as the suitable pasture seeds are seeded in the appropriate season and method, the desired effect will be obtained. Generally, suitable herbages in the project area mainly include: <i>Elymus nutans</i> , <i>Poa crymophila</i> , <i>E.sibiricus</i> and so on. | The project will carry out no-till reseeding according to the degree of grassland degradation; during the soil thawing period before the spring rainy season, the project will complete the ditching, sowing, covering and suppression of soil at same time, and reseed the excellent herbage. The reseeding Choice <i>Elymus nutans</i> , Qinghai Chinese fescue, Qinghai grass <i>Poa pratensis</i> in 1:1:1 mixed. |
| What are the epidemic prevention requirements   | Animal epidemic prevention plans, epidemic prevention plans and  | The content included in the project is carried out accordance   |

|  |   |   |
|--|---|---|
| for the project area?  | feeding and management plans shall be formulated according to the actual situation of the County. The plan is to build an animal vaccination enclosure.   | with EHS of the World Bank.   |
| What are the suggestions for spring -forbidden grazing activities and technology for this project? | The experts who put forward the forbidden grazing in spring must have come up with good operating procedures and no new suggestions. If there are any suggestions, experts are suggested to introduce policy trends, development trends and scientific and technological trends to herdsmen, and at the same time, listen to more feedback from herdsmen. For the technology of forbidden grazing, need to ensure the forbidden grazing. Hope that the order supply can guarantee the forage supply and the quality of forage. Silage grass is recommended. | The project has put forward a plan for forbidden grazing. Also consulted the herdsmen. The design has been carried out in the project feasibility study.                                  |
| Are there training needs in the project area? What kind of training is needed?                     | General policy training is often carried out, there is no necessary for general productive training. The herdsmen themselves know what is better to do. Only practical, convenient implementation of new technologies, new ideas and new methods that are conducive to the restoration of pasture vegetation and the income increase of herdsmen are the most popular options. Hope control experts and breeding experts to teach about the scientific breeding, animal husbandry prevention.   | In the training part of the project, individual design and training can be conducted according to the problems of different regions and different herdsmen in the implementation process. |
| What support does the project need to provide for local pest control?                              | Financial support, field guidance, follow-up research.  | PMP have been made for the pest in this project.  |
| What are the suggestions for the local implementation of this project?                             | I hope that the Beijing project design department can observe and understand the actual situation of the local area, and then determine the route and means for the implementation of specific projects, which will be more effective.  | The project feasibility study unit has done a lot of research on the local area and done the feasibility analysis of the project implementation.  |

The environmental impact assessment consulted the competent authorities of the project area on the design and environmental related issues of the feasibility study. The personnel and time of consultation are shown in Table 7-5.

Table 7-5 Summary of Suggestions from local experts on public participation in consultation

| Name           | Work place  | Position and title | Consulting way            | Consultation time | Consulting site |
|----------------|---|--------------------|---------------------------|-------------------|-----------------|
| Zhou Huakun    | Northwest Institute of Plateau Biology, CAS                     | Researcher         | Electronic questionnaires | 2019.6.18         | Xining          |
| Zhou Bingrong  | Qinghai Institute of Meteorological Sciences                    | Chief/professor    | Enquiry                   | 2019.6.19         | Xining          |
| Shang Zhanhuan | College of grass science and technology, Lanzhou University     | Professor          | Electronic questionnaires | 2019.6.19         | Lanzhou         |
| Shi Jianjun    | Qinghai Academy of Animal and Veterinary Sciences               | Researcher         | Communication             | 2019-6-18         | Xining          |
| Wang Yanlong   | College of Agriculture and Animal Husbandry, Qinghai University | Vice researcher    | Communication             | 2019-6-18         | Xining          |
| Li Shixiong    | Qinghai Academy of Animal and Veterinary Sciences               | Vice researcher    | Communication             | 2019.6.17         | Xining          |

For the implementation of climate-smart grassland ecological management project, the opinions of local experts are summarized in Table 7-6.

Table 7-6 Summary of Suggestions from local experts on public participation in consultation

| Question of consultation   | Summary of recommendations  | Design solution for feasibility study  |
|--|---|--|
| What impact will the project have on local biodiversity conservation? Recommendations for biodiversity conservation in project areas                   | There is the influence, It will increase the grassland vegetation species diversity; Implementing projects will increase local biodiversity; can promote grassland biodiversity conservation.   | Based on this principle, feasibility study carried out relevant design and activities.   |
| Are there any invasive species in the project area? For example, will the foreign feed (forage) purchase bring Invasive alien species, pests diseases? | Do not have commonly, risk of alien species invasion is small, because local climate is cold, unfavorable breed disease and insect pests; foreign herbage will cause some effects, but due to the weak adaptability of exotic species in high altitude areas, their native adaptability will be very low, and generally difficult to adapt. There is a risk of invasion of foreign species, such as the introduction of wild oat grass seeds into manual planting grass, microbial invasion in the process of introduction; This risk can be reduced by means of strengthened management, preliminary evaluation tests before the introduction of herbage, etc. The Qinghai-Tibet plateau has a special ecological environment, and foreign species cannot survive, so there is no harmful. There is little risk of invasive alien species in the project area. | The project starts the review process, and the forage seed source is strictly tested, see EMP; Measures have been developed to remove the invasion of wild oats. |
| What are your thoughts or suggestions on the project of no-till reseeded and manual  | No-tillage reseeded significantly inhibited the prevention and control of soil erosion and sandstorm damage. It is an important method to restore the   | Selected Elymus nutans, Qinghai Chinese fescue, Qinghai grass Poa pratensis, Qingyin No.1,   |

|  |  |  |
|--|--|--|
| planting grass? Any Suggestions on the selection of grass species?                                 | natural grassland near the nature. It is suggested to choose flat grassland for reseeded. For grass species, they are recommended to choose native grass species.  | Qingyin No.2, Qinghai 444 and Vicia sativa are native grass, their has been cultivated for a long history. The principle of selecting implementing place for no-tillage reseeded project is contiguous and flat. |
| What are the epidemic prevention requirements for the project area?                                | Warning should be strengthened and paid attention to at all times; It should be implemented in accordance with the provisions of the state on epidemic prevention.   | The content included in the project is carried out in accordance with EHS of the bank.   |
| What are the suggestions for spring -forbidden grazing activities and technology for this project? | According to the grass green and climate conditions, to formulate specific grazing technology; supporting facilities for forbidden grazing and supplementary feeding; considering the local climate, geography and natural conditions, follow the principle of seeking truth from facts, not one size fits all. In order to ensure the effect of forbidden grazing, we should communicate fully with the farmers involved in the project. The level of enclosure should be improved, including nutritional status, physical condition and adaptability. Strengthen the breeding and management of livestock after forbidden grazing. | The project has put forward a plan for grazing rest. Also consulted the herdsmen. The design has been carried out in the project feasibility study.  |
| Are there training needs in the project area? What kind of training is needed?                     | There is demand. Science popularization may be more important: the training of local herders on science popularization, with the support and participation of local public; Grass planting technical training, laying a personnel and technical foundation for the continuous implementation of the later project; Technical training of related projects to improve the production and management level of herdsmen grass. It is the rational utilization and scientific management of grassland. Technical training on farm operation is required. On-site training should be combined with actual production.                     | In the training part of the project, individual design and training can be conducted according to the problems of different regions and different herdsmen in the implementation process.                        |
| What support does the project need to provide for local pest control?                              | Prediction, early warning, appropriate control agents; need to determine the effective control area; need technical support; strengthen rodent control and increase investment.  | EMP has been made for the pest.  |
| What are the suggestions for the local implementation of this project?                             | Strengthening the monitoring and assessment of livelihood impacts: further strengthening local implementation of projects to bring demonstration effects; Joint implementation of multiple projects. The project is very down-to-earth and the implementation is stepped up. The   | The project feasibility study unit has done a lot of research on the local area and done the feasibility analysis of the project implementation.   |

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|  | project combines the actual needs of local ecological protection and production development. |  |
|--|--|--|

**7.4.2.2 Peasant household survey**

The project team made field investigations in Moele town, Qinghai province from July 13 to 25, in 2018 and November 19 to 24, in 2018. From January to April 2019, Moele town conducted a survey on farmers in the project area according to the requirements of experts. From May 9 to 11, 2019, farmers in the project area were visited and investigated. The sign-in form and photos of the visit and investigation were shown in figure 7-4.



Fig. 7-4 Survey of farmer households in the project area

(1) Sampling Methods for cooperatives and herders

Information on 6 villages, 27 cooperatives, 116 herder cooperation groups and herders in the town of Moeller, where the project is located, was collected through field interviews and other means. The cooperative group of herders here is an informal organization established in accordance with the needs of the project and on the basis of the herders' original animal husbandry production activities, such as shearing wool, sheep dung and yak hair, etc. Given that the project will be based on pastoral groups, 58 of which will be randomly selected as the implementation areas and the remaining 58 pastoral groups as the control areas, these groups will be distributed in most or all cooperatives in 6 villages. Since pasture contracting is at the community level, we took all the 27 cooperatives as project cooperatives, and randomly selected one herder from each group as the sample herder. In addition, as a more formal organization, we have considered cooperatives.

### (2) Survey content at the social level

- The basic situation of the population, such as the distribution of the population and its age, gender, ethnic composition and educational attainment; Sex, age and education of the labor force in the population; The situation of non-pastoral employment; The situation of livestock-free households, poor households and "five guarantee families"; Grassland warden situation;
- Land and grassland transfer: total grassland area, grassland classification and area; The circulation situation of the grassland (in, out and contract circulation); Substitute grazing situation; The size distribution of pastures of different herders;
- Animal husbandry production: number of livestock and their types and age structure; herders distribution of different livestock sizes; livestock sales, etc.;
- participated in projects such as spring break grazing;
- socialized services for animal husbandry production: livestock insurance, pest control, grassland fire prevention, veterinary medicine epidemic prevention, animal husbandry technology promotion, disaster relief (such as white disaster and black disaster), etc.;
- division of grass and livestock and implementation of balance between them: the time and mode of contracting, the type and area of grassland, the supervision and execution of the balance of grass and animal.

### (3) Survey content at the level of herders

- Basic information of the herders, including: the basic characteristics of the respondent (usually the head of the household) (age, gender, ethnicity, village cadres or not, grazing experience) and the family population and their employment;
- The status of the pasture in the home: the type, area and use of the contracted grassland (whether or not the area is rotated); whether to plant oat grass;

- Grassland Leasing situation: rental and lease, area, contract, lease period, price, object and lease reasons, etc.;
- The situation of foster care for livestock;
- Income from family husbandry;
- The status of family animal husbandry and consumer expenditure;
- Family Loan situation: Amount, source, term, interest, use and loan reasons, etc.;
- The implementation of Grassland Ecological award policy and herders' perception, including the balance of grass and livestock and the prohibition of pastoral;
- The production decision of herders: the number and reason of raising and acquiring livestock, the livestock decision-making and the view on the future development of animal husbandry;
- Perception of and response to climate and ecology;
- Pastoral production season calendar.

#### (4) Survey method

The survey was conducted using field visits (July 11-16, 2018; July 19-24, 2018), questionnaires, telephone interviews, and design web interviews (questionnaire stars). From January to April 2019, a small supplementary survey was conducted by telephone and WeChat.

The distribution of villages, associations, groups, herdsman and cooperatives in the sample area is shown in Table 7-7.

Table 7-7 Distribution of project committee, groups and herders reported

| village   | Committee<br>(unit) | Group<br>(unit) | Herder<br>(household) | Cooperatives<br>(unit) | Cooperative herder<br>(household) |
|-----------|---------------------|-----------------|-----------------------|------------------------|-----------------------------------|
| Hailang   | 6                   | 29              | 408                   | -                      | -                                 |
| Duolong   | 4                   | 16              | 260                   | 1                      | 44                                |
| Wa Riga   | 4                   | 20              | 216                   | -                      | -                                 |
| Cai Shitu | 4                   | 16              | 193                   | -                      | -                                 |
| LaoRigen  | 5                   | 25              | 265                   | 1                      | 42                                |
| Zhasha    | 4                   | 10              | 165                   | -                      | -                                 |
| Total     | 27                  | 116             | 1507                  | 2                      | 86                                |

Data source: survey conducted November 19-24, 2018

#### (5) the analysis of survey data

According to the analysis of survey data, at present, the average size of herding households in each community in Moeller town is 56, and the average herding population is 186. The number of male and female herding households is symmetrical. However, the number of herding households with livestock only accounts for about half of the total number of herding households. And some herders have no grassland at all.

For poverty in pastoral areas, 9% of the total pastoral households in each community subject to poverty. However, most of these poor households are precisely supported by the

state. In terms of the distribution of population age, shown in Table 7-8. In general, the population age distribution is relatively concentrated, with young and old people being the majority. Among the population engaged in grazing, the education level is basically junior high school or below, and the education above senior high school is rarely grazing.

Table 7-8 Age distribution of population of Moeller

|                           | Min | Max | Mean | std   |
|---------------------------|-----|-----|------|-------|
| More than 60 years of age | 16  | 230 | 37   | 47    |
| 20 to 60 years old        | 80  | 220 | 157  | 35    |
| 10 to 20 years old        | 14  | 89  | 42   | 20.87 |
| Under the age of ten      | 10  | 70  | 27   | 14    |

Data source: community level survey

Table 7-9 shows education of people with different ages. The overall education level is low, suggesting that illiterates account for a large in each community. The standard deviation indicates that the distribution of illiterates varies greatly among different societies. Education level in this region needs to be improved urgently.

Table 7-9 Education level of the sampled population in communities of Moeller town

|                              | Min | Max | Mean  | Std   |
|------------------------------|-----|-----|-------|-------|
| Senior high school and above | 4   | 35  | 14.53 | 9.31  |
| Junior high school           | 3   | 100 | 27.53 | 23.68 |
| Primary school               | 7   | 100 | 42.16 | 31.69 |
| Illiteracy                   | 6   | 203 | 90.58 | 67.37 |

In terms of ethnic distribution, Tibetan, Mongolian, Tu and Hui ethnic groups in this region account for a large share while other ethnic groups account for a small proportion. The region account shows table 7-10.

Table 7-10 Population distribution of all ethnic groups of sample community in Moeller town

|                     | Min | Max | Mean  | std   |
|---------------------|-----|-----|-------|-------|
| Tibetan             | 1   | 230 | 87.68 | 62.15 |
| Mongolian           | 38  | 241 | 131.4 | 50.27 |
| Hui                 | 0   | 87  | 23.21 | 23.78 |
| Tu                  | 0   | 19  | 4.63  | 6.52  |
| Other ethnic groups | 0   | 30  | 6.89  | 9.57  |

Animal husbandry production is the main livelihood activity of herdsmen. Among the investigated herdsmen, 97.4% of them regarded animal husbandry as their only source of income, and only 2.6% of the households have members going off-farm jobs and having income sources from non-livestock production. Different from other grassland pastoral areas such as Inner Mongolia, the animal husbandry in the project area still graze in a traditional way. Only 15.8% of the herdsmen carry out house feeding or semi-house feeding production. Grassland and labor are the most important inputs in animal husbandry production, and infrastructure such as machinery, sheds and wells in animal husbandry production is extremely low.

Herdsmen's cognition of grassland ecological situation. According to the field surveys,

grassland degradation is serious in Qilian County. The area of moderately and above degraded grassland is about 5.1 million mu, accounting for 33% of the available grassland area. Among them, the moderately degraded grassland area is 4.4 million mu, accounting for 28.4% of the available grassland area, and the heavily degraded grassland area is 700,000 mu, accounting for 4.4% of the available grassland area.

In the animal husbandry production, the herdsman will consider the ecological situation of the grassland to a certain extent, and adjust the amount of livestock raised according to the precipitation and the growth of pasture. Table 7-11 shows the main considerations for decision-making in animal husbandry production. Pastoralists generally said that grassland ecological protection is necessary, and local religious culture and traditional customs emphasize the respect of grasslands and the protection of ecology. In the animal husbandry production, the herdsman mainly exert excessive negative impact on the ecology through seasonal rotational grazing and leased pasture to control production. In addition to these measures, the herdsman rarely take other measures that are beneficial to the ecological protection of grassland, such as supplementary feeding, semi-house feeding and artificial reseeded. Therefore, although the herdsman have a supportive attitude towards grassland ecological protection as a whole, some measures have been taken to control the negative effects of production on grassland ecology. However, in view of the degree of grassland degradation in Qilian County, these measures are obviously insufficient to achieve the goal of grassland ecological protection.

Table 7-11 Determinants of herders' production decision-making

|                      | Forage growth | Household consumption demand | Livestock sales price | Loan repayment demand | Ecological policy |
|----------------------|---------------|------------------------------|-----------------------|-----------------------|-------------------|
| Quantity (household) | 49            | 25                           | 21                    | 16                    | 4                 |
| Share (%)            | 67.1          | 34.2                         | 28.8                  | 21.9                  | 5.5               |

Female herders accounted for 27.1% of the total herders in the town, with the highest proportion of women in Lao Rigen Village (44.8%), 23.3% in Duolong Village and 20.6% in Wariga Village. However, in the only two animal husbandry cooperatives in the town, female herders accounted for 15.11% of the total herdsman in the cooperative, of which the female participation ratio of Lao Rigen Cooperative was 19.05% and that of Duolong was 11.36%, which were far lower than the proportion of female herders in the whole village. In general, the number of women participating in cooperatives is few and their age are older than men.

Since the project has been publicized and investigated in different forms in the project area since 2014, almost all the sample herders know about the project, but the specific implementation of the project, such as which villages or communities will be implemented, and the specific measures of the project are still unclear. With the progress of the project, herders in the project area, especially women, will be informed of the progress of the project

and their opinions and suggestions in time.

### 7.4.2.3 Publicity of project area

May 14–June 21, 2019 to publicize the project.

| The project area             | Form               | Place   |
|------------------------------|--------------------|---|
| Moele town, qinghai province | Post of the public | Villages to be implemented in the moeller town project in qilian county, qinghai province: zhasha village, caishi tu village, dolong village, hailang, warigari, laorigen |

Public notices will be posted in all villages of the proposed project in Moele town, Qinghai province. The publicity mainly introduces the content of the project implementation, including technical content, the impact of the construction project on the environment and the prevention and control measures. Public photos are shown in Figure 7-5.





Figure 7-5 Project information publicity photo

Through the environmental impact assessment analysis, the environmental impact during the construction of the project is temporary and recoverable, and the strict implementation of environmental assessment mitigation measures can reduce the impact to the minimum; The impact on the environment during the operation period is mainly positive. Through the implementation of some advanced technologies, the impact on the environment is minimized.

With the implementation of the project, it can promote the virtuous cycle of the ecological system in the project area and increase the income of the pastoral area.

## 7.5 Public participation requirements

After the project site selection is determined, the public shall participate in the project site selection area in the form of publicity, questionnaire and other forms, and adjust the project site selection and environmental protection measures according to the feedback opinions to meet the wishes of the nearby public.

## 7.6 Expectations and requirements of different stakeholders for project activities

The survey and discussion found that herders, technicians and government officials showed great interest and enthusiasm for the project, and eagerly hoped that the project could be carried out within their own geographical area.

### 7.6.1 Expectations and requirements of provincial, state and county governments for project activities

The government department think the grassland resources as the best ecological resources. Therefore, to systematically manage grassland ecology is extremely urgent. Governing the black soil beach, protecting the grassland, and taking a path of sustainable

development of grassland is an important practice of the "two mountains" theory. It is hoped that through the implementation of this project, they will cooperate with the ecological terminal, research institutes and the World Bank, including the experience of the World Bank, and integrate the use of technical forces in grassland management to better control grassland. Qilian is a national key county for grassland ecological management, a rural tourism demonstration county, and the country's largest organic pasture. It is hoped that the implementation of the project will solve some problems in the ecological protection of Qilian grassland. At present, Qilian County is implementing an ecological compensation program, implementing ban on grazing on 5.11 million mu of degraded grassland and implementing grass-animal balance on 10.4 million mu of grassland. And cooperating with the expert team to carry out desertification management, control the black soil beach through non-tillage and supplementary sowing.

They suggested that they can be based on cooperatives, with a part (one-third) of the cooperatives as a treatment and a part (two-thirds) as a comparison. The sheds and grasses in the matching funds can be tilted to the project, but the ecological compensation is not easy. It is hoped that the project will take the village as the unit, half as the project village and half as the control village, otherwise the non-project cooperatives in the same village or the non-project mutual aid groups in the same community will complain. Traditionally, neighboring herders are accustomed to mutual cooperation. If the project separates them and the implementation of the project causes a large gap in income or welfare, it may be unfavorable for the future mutual assistance and cooperation of the herdsmen.

### **7.6.2 Expectations and requirements of the town government for the project activities**

The town is trying to implement a new grazing model: rest grazing in spring, nomadic in summer, rotationally grazing in autumn, freely grazing winter. The natural conditions there are harsh, the altitude is high, the temperature is low; the financial investment is insufficient, the number of greenhouses is few, and the oats are sometimes not harvested; the products are sold in a single way, the market is insufficient, and the secondary and tertiary industries are lacking. The town welcomes this project very much, and will set up a program management office to cooperate with experts and do a good job. The veterinary station said that if the people were to pay for their own grass, the goal of the project would fall short. It was suggested that the Agriculture and Animal Husbandry Department should tilt the project to Qilian and try to make the project cover more herdsmen. Without the support of the project, even if the grasslands of the herdsmen are seriously degraded, their cattle and sheep still need to use the grasslands. Supplementary feeding should be carried out in critical period.

Participation in projects on a community basis is easier to implement. The town believes that the quality of grassland is the evaluation standard, and the grassland will be compensated if it reaches a certain quality, as long as the compensation is equal to the previous pastoral income, the pastoralist can accept it. The herdsmen have the awareness of protecting the grasslands and accept ecological protection, but do not accept income reduction. Therefore, economic sustainability issues after abandoning feed need to be considered.

### **7.6.3 Expectations and requirements of villages, communities and cooperatives for project activities**

The village community believed that the effect of forbidding grazing was good. The first round forbidden grazing summer pasture was adjusted to the second round of forbidden grazing autumn pasture. The ecological payment system granting compensation to households is simple and unscientific. Herders may not have to change the stocking rate. The grass can affect the herding behavior of the herders. They hope to replace the monetary payment with grass. Some village leaders believe that if the people do not go to the pastures after getting the money, they can reduce the amount of livestock. But if let them feed, the cost is too high, and it is difficult to get access to drinking water. They hope households without any livestock can transfer their grassland, so that the herders with livestock can rent in those grasslands conditionally, such as not causing the degradation of the leased pastures. In this way, both households with and without livestock can benefit equally. The village heads also said that the herders are accustomed to stocking livestock, so it is difficult for the herders to accept captive feeding.

According to the cooperative, non-tillage and supplementary sowing, rest grazing in spring, scientific breeding is very popular with herders, but it wastes feed and costs a lot. Measures such as pulling out the net fence of winter and spring grasslands can only be done by cooperatives. The surrounding cooperatives have a 40-day forbidden grazing period (from mid-May to early July), during which livestock are fed in captivity, purchased forage, and rented grasslands from other places.

### **7.6.4 Expectations and requirements of herders for project activities**

The representatives of the herders believe that the main reason for the serious destruction of the pastures is that the livestock is being developed too fast, and the pastures need to be built to meet the needs of cattle and sheep. If the compensation is high enough to offset the loss of income from the reduction of livestock, the herders are willing to ban the grazing to protect the pasture. At present, none is willing to reduce livestock, mainly because

income is not guaranteed. Some herders think that when grass sprouts, livestock are not allowed to eat, so the effect of rotating grazing is as good as that of resting grazing. Herders' perception of forbidding grazing: they used to think that when forbidding grazing, he would not graze sheep, others would come to graze sheep. Grass is eaten and can grow. Now the herders have the awareness of protecting the grassland. As long as they can offset the loss of income caused by the reduction of livestock, the herders are very willing to ban the grazing to protect the grassland. However, grazing resting and prohibition require more labor to supply water and feed livestock. Some herders are facing serious difficulties for livestock to drink water, and need to drive livestock several kilometers away to drink water. Some of them spend tens of thousands of dollars to buy water carts, and take water to drink livestock every day. The time and cost are huge. If the animals are housed, the problem on drinking water will become more severe.

For rodent and pest management. The occurrence of rodents and pests is frequent and serious in the project area. Herders said that although they governed it year after year, rodent and pests still occur, which has aggravated grassland degradation to some extent. Because the management of rodents and pests has some characteristics of public affairs, the overall effect of the control in small areas will not be ideal. The herders require to control rodents and insect pests on a large scale.

As for the way of ecological reward and compensation, herders think that it is reasonable to formulate policies according to the area. Because the income of compensation is not used by herders to decide the scale of their livestock farming, it is used for family living expenses. When asked about the level of the award criteria, the herders did not feel low, and it was difficult to indicate how high the standard of rewards could affect their livestock raising behavior. However, they believed that the implementation of grass-livestock balance and forbidden grazing would be effective for grassland restoration. The local practice is generally to forbid grazing in autumn or summer grasslands. When the grass sprouts in spring or seeds in autumn, it is not allowed to graze. But in winter it is just as well to let sheep and cattle graze on the forbidden pasture for a short time.

In a word, from the experience of pastoralists, scientists and technicians, as well as villagers and local governments, participating in projects is beneficial. However, because the proposed project is significantly different from the government-driven project, these stakeholders, especially the herders may have some misunderstandings about the implementation of the project. For example, the current policy of ecological compensation has become to an inclusive policy to increase herders' income, but it has not played a role in encouraging or restricting herders to limit livestock so as to protect grassland ecology. Another example, the spring grazing rest policy which is being implemented in a small scale

in the project area is a good welfare for project households only by supplying forage and feed to project households and building shantytowns. However, the expected demonstration effect of "spring grazing rest-relieving grassland pressure-restoring grassland ecology" is not obvious enough. The proposed project will compensate herders strictly according to their livestock production behavior, such as the amount of livestock raised, the length and duration of livestock grazing in winter and spring grasslands, and the impact of these behaviors on grassland ecology. This procedure is different from that of rewarding or compensating herdsman first, then restraining or encouraging herders' behavior, but first according to their behavior and effects, then approve the strength of rewards and supplements. This may cause the herders to have a sense of distrust and fear that they will not be able to get enough compensation after they have done so as to weaken their enthusiasm to participate in and implement the project.

# Chapter 8 Social impact analysis

## 8.1 Social impact analysis of the project

The project takes Moller Town, Qilian County as the project area, and helps the selected herders to establish an informal alliance. Through natural grassland management such as spring grazing rest, supplemented by small-scale manual planting grass and captive feeding, the project can better manage the summer pasture shared by herders. It also controls the grazing of winter pastures during spring growth to pilot a new model of grassland management, and implements an empirically based ecological compensation mechanism. Based on this, the project will carry out climate-smart grassland ecosystem management demonstration and knowledge management to promote the sustainable development of ecologically fragile pastoral areas that are sensitive to climate change and concentrated in ethnic minorities. If the project can be implemented smoothly according to the planned plan, it is expected to bring about the following social impacts.

### **8.1.1 Change herders' traditional grazing habits to make animal husbandry more intensive and efficient**

The implementation of the project will help change the habits of herders grazing on natural grass all year round. Natural grassland management activities such as spring rest grazing, captive feeding, and manual planting grass cannot only restore grassland in key periods such as grass germination and seed maturity, but also reduce the fat loss of livestock to a certain extent. Optimized forage can also help to adjust the nutritional structure of livestock, so as to make animal husbandry more intensive and efficient.

### **8.1.2 Change herders' concept of ecological compensation and encourage them to voluntarily protect grassland resources**

The existing ecological compensation policy in the project area is distributed to the herders according to the grassland area contracted by the herders' families and the criteria of forbidding grazing and grassland-livestock balance. The empirical grassland ecological compensation policy implemented by the project will strictly implement the ecological compensation policy in accordance with the approved livestock carrying standard, that is, the participating households will be compensated for the losses caused by reduced livestock, and to reward the ecological products brought about by the protection of grassland. Through the

implementation of the project for many years and its demonstration effect, the herders' concept of compensation is improved, so that herders can voluntarily protect grassland resources under the new ecological compensation mechanism.

### **8.1.3 Enhance herders' ability to accept new technologies and improve their sustainable livelihoods**

During the implementation and demonstration, the project will provide consultation and guidance on animal husbandry technology, and use the agricultural technology promotion platform and the Agricultural Broadcasting School to train new types of professional farmers and herders, improve the technical acceptance of herders, enhance their human capital, broaden their livelihood strategies, and then improve herders' sustainable livelihood level. The adoption of new animal husbandry technology by project participants and the improvement of their livelihood level can also promote the adoption of technology and livelihood improvement of pastoral households in the whole project area, thus promoting the sound and rapid development of pastoral areas.

## **8.2 Potential social risks and countermeasures of the project**

The eastern margin of the Qinghai-Tibet Plateau and the southern side of the Qilian Mountains are typical mountain grassland ecosystems. They are the key counties for national ecological protection. Most grasslands in the region have been designated as national parks and nature reserves. Since 2011, they have been the target counties for the implementation of the national grassland ecological reward and compensation policy. The elevation, climate, grassland type, animal husbandry production and herders' livelihood of the project village are typical and representative in the Qinghai-Tibet Plateau. Although the average per capita income of these six project villages is higher than the national average, absolute poverty still exists and relative poverty occurs frequently. Some precise poverty-alleviation households got rid of poverty on schedule, but some new herders fell into poverty. Previous research shows that stakeholders in the project area show great enthusiasm for the project. However, the implementation of the project will involve complex and diverse socio-economic factors (such as: from the degree of organization, infrastructure conditions, and natural environment, etc., the situation of the six villages involved in the project is quite different. There are animal husbandry cooperatives in Laorigen and Duolong villages, but not in the other four villages. Infrastructure conditions vary greatly from village to village. For example, the average distance from each herdsman group in Zhasha village to the market and the medical and health centre is less than 10 kilometers, while Wariga, Duolong and Caishitu are all 20 kilometers away, some even more than 30 kilometers. The elevations of the villages are not

equal. For example, the average elevation of Zhasha Village is 3,200 meters, while the average elevation of the Wariga Village is about 3,550 meters. The herders report that due to the influence of high altitude, some of the herders' winter nests cannot grow oats grass. In addition, the resource endowments of grasslands and drinking water sources in different villages are different.) Therefore, it is necessary to analyze the risks of social stability that may be caused by these factors.

### **8.2.1 Coordination of relationship between project households, project groups, and project villages are needed**

According to the project plan, the project will be based on 116 herder groups of 27 communities in 6 villages of the town, based on transparent, open and voluntary, 14 communities were randomly selected as project intervention communities and the remaining 13 as control communities. 3 mutual-aid groups were randomly selected from each mutual-aid group (2 were selected for those with less than 3 mutual-aid groups). In each mutual aid group, 4 households were selected as project intervention households according to the intention and actual situation of herding households, and a total of 160 households were selected as project activity intervention households. As the participation of six villages and their 27 communities and herdsmen groups in the project may vary, this will inevitably affect the resource allocation between villages and villages, between different communities in the same village and among different herdsmen groups in the same community.

What needs coordinate is that for project groups with an average of 15 herdsmen, a random selection of 4 households as project households may have negative effects on other herdsmen in the same project group. Compared with other groups of herders, the same group of herders have closer settlements and more mutually beneficial activities in daily animal husbandry production, such as shearing wool and sheep manure. If project participants benefit more from the project, it may widen the distance between project participants and non-project participants, thus affecting the implementation and demonstration of the project.

### **8.2.2 The project area's workforce is feminized and aging seriously**

The age of the project villages is relatively large, and the feminization is serious. The feminization of the herders in the Laorigen village is quite high, and nearly 45% of the herders are women; the overall trend of the aging population of the village is obvious. The average age of male and female herders is 52 and 51.5 years old; both male and female herders over 70 years old account for 12% of the total herders. In some villages, the proportion of elderly female herders is high. For example, the average age of female herders

in Duolong village is 52 years old, of which a quarter are between 60 and 70 years old, and 6.3% are over 70 years old.

On the other hand, according to our telephone interviews at the community level in the project area, the life expectancy of males in some communities is relatively short. Therefore, from the average age of herders, it seems that there is no problem with the aging of the labor force. For example, the average age of male herders is less than 45 years old, while the average age of female herders is nearly 55 years old in Wariga. The average age difference between men and women is about 10 years. According to the information at the symposium, 70% of the young people in the village work outside, and almost no one is willing to graze at home or back home.

outside and almost no one is willing to graze at home or back home.

### **8.2.3 Grassland is small and fragmented, and grass circulation is common**

After most young and middle-aged herders get married, they separate the pasture from their parents, so the pasture is fragmented. According to the survey data of 114 herders, 27.1% of herders in Muller have their own winter and spring pastures with an area of less than 600 mu, the smallest of which is only 173 mu, with an average of 1123 mu. Grassland circulation is common, with about 50% of households with livestock renting in winter and spring pastures.

The small-scale fragmentation of grassland may have a certain impact on the implementation of the project. And the circulation of grassland may also be affected by the project. The field interview found that some farmers will increase the intensity of the use of leased pasture due to the implementation of spring rest on their winter and spring pasture, transfer the grazing pressure to leased pasture and aggravate the degradation of leased pasture.

### **8.2.4 Village level organization**

Of the more than 1,000 pastoral households in the six villages covered by the project, there are two pastoral professional cooperatives, with only 86 participating herders, accounting for 6 percent of the total, accounting for 16 percent and 18 percent of the villages of Duolong and Laorigen, respectively. However, the interview found that herders had a fairly common practice of mutual assistance in activities such as shearing sheep, shoveling sheep manure and rubbing cow hair, and that these loose support groups can sometimes be as large as 20 people. In general, the village-level organization level in the project area is low, and the self-service ability of herders needs to be improved. To some extent, this will have a great negative impact on the organization and implementation of project-related technologies.

### **8.2.5 The carrying capacity of livestock in the pasture is high, but the captive breeding rate is not high in winter**

Due to the pursuit of higher livelihood level and the livestock market, labor force and credit market, the livestock carrying capacity in winter and spring pastures is generally high. According to the survey of 116 pastoral groups and one family in each group, if only their winter and spring pastures are taken into account, and the leased pasture area and purchased forage are excluded, the average stocking rate of each group in 6 villages in the project area is 3 mu of winter and spring pastures per sheep unit on average. Few of the herders interviewed bought forage, except in the case of disasters or participated in projects such as spring grazing rest, but such herders were rare. It is assumed that each household rented grassland and the area of their own pasture is equivalent, so that the actual livestock carrying rate is about 6 mu of a sheep unit, with the local reasonable load of 8-14 mu of a sheep standard is also far away. This makes it possible for the implementation of the project to require the target herders to lose a large quantity of livestock.

On the other hand, the herdsmen who used the method of captivity in winter accounted for only 15.8 percent of the total sample, i.e. only 18 of the 114 herders were in winter captivity. Most herders keep their traditional livestock grazing habits. The availability of forage for captive breeding can be a problem. At present, less than one-third of all herders are planting wheatgrass in their winter dens. Some herders live at higher elevations, and the weather is arider, so the effect of planting wheatgrass is not good. And the whole Qilian has 38,000 mu of arable land, which can grow pasture area is limited. Most of the forage needs to be bought in neighboring counties such as Menyuan or Shandan, which is expensive to transport. In addition, there is a need for more labor (water pulling, supplementary feeding, etc.) in captivity, so the condition of the labor force in pastoral households may be a limiting factor.

Higher livestock loads and low captive breeding rates may have an impact on the implementation of the project.

### **8.2.6 Climate change may affect project implementation**

In addition, natural disasters caused by climate change may also affect project results at demonstration sites. According to the investigation, three cattle were washed away by mudslides in 2016 during heavy rains in the pasture of some farmers. Two consecutive years of snowstorms in 2015-2016 also caused huge losses of more than 150 sheep and more than 50 cattle in some herders' homes. The cattle and sheep that survived weren't strong either, and it wasn't until 2018 that their numbers and health returned. Climate change may cause some

economic losses to herders, and also have an impact on the demonstration effect of the project. In addition, according to the report of herders, due to drought, low temperature, frozen water pipes cracked, some villages nearly 20% of herders have livestock drinking water difficulties, need to go 3-5 kilometers away to drink water or buy a water cart to manually pull water. According to the climatic data of Moller town, the lowest temperature in December 2017 was 31.8 degrees below zero, while the precipitation data showed that from October 2017 to April 2018, there was no precipitation in Muller town. From May to June, the precipitation was less than 20 millimeters, but from August to September, the precipitation was nearly 200 millimeters, and the rainfall was very concentrated. Lack of rain at the turn of spring and summer also affected forage germination and growth. Low temperature and seasonal drought, as well as concentrated precipitation, may affect the implementation of the project.

### **8.2.7 Grass-roots pastoral technology promotion is weak, and the technology acceptance ability of herders is weak**

Qilian has only 80 agricultural technical extension personnel, if spread equally to every township, then every township can have 11 agricultural technical extension personnel. That means each promoter is responsible for more than 300 square kilometers of Moller's 3,826 square kilometers. Coupled with the harsh climate, complex terrain and transportation conditions, as well as living very scattered herders, this makes the spread of animal husbandry technology is quite weak. Although departments at all levels have strengthened their efforts in technology promotion and set up science and technology demonstration households. For example, 20 yak science and technology demonstration households and 36 sheep science and technology demonstration households have been set up in the town of Moller, these demonstration households still account for less than 5% of the total herding households. On the other hand, the aging of herders and the generally low education level also hinder herders' acceptance of technology to some extent. According to the survey at the community level, 70% of the herdsmen have less than primary school education, among which 60% have never received a formal education. These two factors should be taken into account in the design and implementation of the project.

## **8.3 Policy recommendations to improve the social impact of project implementation**

The implementation of the project is accompanied by a series of social problems. As

mentioned above, the relationship among some project households, project teams and project villages needs to be coordinated. Moreover, the current labor force in the project area shows a trend of feminization and aging, and problems with ethnic minority women needs to be solved urgently. In addition, a large number of herdsmen have small scale of grassland; so, in order to expand the operation, only grassland circulation can be carried out, which increases the social cost. It is found from the implementation of some national policies that the low level of village-level organization is not conducive to the implementation of policies. From the ecological point of view, the livestock carrying capacity of pasture is high, while the captive breeding rate is not high in winter, which increases the pressure on the pasture. Moreover, the project locates in the high-altitude, cold area with a highly variable climate, which will also affect the project implementation. Finally, the quality of the population of ethnic minorities in the project area is a problem, which is particularly reflected in the weak promotion force of grass-roots animal husbandry technology and the weak acceptance ability of herders, which may hinder the implementation of the project.

Based on these, in order to enable the project to be implemented smoothly and effectively, to meet the requirements of each group for the project, and to maximize the social benefits of the project, this report proposes the following policy recommendations based on the potential social risks faced by the project implementation, the minority development issues and restrictive access issues involved in project implementation, on the basis of full respect for local culture and customs, freedom, preposition and negotiation.

### **8.3.1 Suggestions on the coordination of the interests of vulnerable groups**

For coordination of the interests of vulnerable groups, the overall principle is to ensure that their rights are not harmed and to provide them with as many development opportunities as possible, so as to help them build their capacity so that they can maintain the sustainability of their livelihood. The coordination of interests involved in project implementation mainly includes the coordination of interests between project households, project teams and project villages and non-project households, non-project teams and non-project villages, and the relationship between vulnerable groups such as women and elderly herdsmen and non-vulnerable groups, as well as the coordination of interests of ethnic minority groups and restricted access to groups due to projects.

For the interests of project households, project teams and village associations and non-project households, non-project groups and non-project village associations, the project office and the local government shall, according to the specific conditions of each village, establish corresponding project coordination groups and project implementation groups at the village and community levels to coordinate the allocation of project resources. On the basis

of unified project planning and design, the principle and standard of project resource allocation should be clarified to avoid social conflicts caused by it, and a transparent system of project resource allocation and herders complaint mechanism should be established.

For vulnerable groups such as women and elderly herders, women's needs should be understood during the implementation of the project, gender equality should be taken into account, and women's right to participate should be guaranteed. In particular, effective project information and technical support should be provided for women. In order to ensure a smooth implementation of the project, it is necessary to provide corresponding intensive technical training to the herders, especially the elderly herders, and provide effective socialized technical services to them.

The interest groups of ethnic minorities should respect their customs and religious beliefs, give due consideration to the proportion of ethnic groups, and try their best to benefit all ethnic groups equally. For the restricted access groups involved in the project implementation, their rights and interests should be protected from the losses caused by the project implementation. They should be fully consulted and compensated in a way acceptable to them.

### **8.3.2 Suggestions on the organization and capacity building of project village households**

The organization and capacity building issues involved in the implementation of the project include the low level of organization at the village level, difficulties in the formal cooperation of herders, the weak promotion force of grass-level animal husbandry technology and the insufficient capacity to cope with climate change. In view of the low level of village-level organization and the difficulty in dealing with various risks and uncertainties in pastoral areas, we can start from two aspects: first, take corresponding measures to cultivate professional cooperatives of herders and give effective incentives; Second, encourage herders to carry out various forms of spontaneous cooperations, such as shearing sheep, shoveling sheep manure and rubbing cow hair, and on the basis of these mutual assistance activities, adopt relevant incentive measures to cultivate the establishment and operation of professional cooperatives of herders with certain market capacity. To solve the problem of weak popularization of grass-roots animal husbandry technology, the project can be used as an opportunity to innovate the technical service mechanism and strengthen the technical service team of towns and villages. The project may allow for: establishing a rural organic integrated animal husbandry socialized technical service system, focusing on the implementation of the project; adopt effective training models and mechanisms, taking into account ethnic herdsmen, and cultivating a certain number of herders technicians and technology

demonstration households, especially women; use the national agricultural technology extension service information cloud platform to provide intensive training for township and village community technicians and pastoralists. As climate change brings more rain to the project area, it is necessary to consider measures to cope with climate change such as low temperature in winter, seasonal drought in winter and spring, and concentrated precipitation in summer and autumn; Further strengthen the socialized service of livestock insurance; Farmers are encouraged to participate in policy-based insurance for natural disasters.

In short, in the long run, single-family-based livestock production will face many unfavorable factors, especially under climate change. Future pastoral development requires the development of informal mutually beneficial cooperation and more formal cooperative organizations so that livestock production can use resources more efficiently, implement more eco-friendly measures and target a broader livestock product market. The implementation of this project is expected to make a useful attempt in these areas.

### **8.3.3 Suggestions on pastoral habits and grassland leasing issues**

In view of the high load of livestock in the pastures of ethnic minority herders in the project area, and the low rate of winter captivity, it is necessary to take the project as an opportunity to guide the herders to: change the traditional way of stocking livestock; rely on the technology provided by the project to improve the quality of livestock products; and help the herders obtain the certification of high-quality livestock products, so as to improve the price and operating efficiency of livestock products. The livestock load in the pastures may thus be reduced. As for the issues of pasture fragmentation and the common but not-standard grassland circulation, the following practices may alleviate the problem: strengthen the guidance of the herders; make the project measure as far as possible to cover its contracted winter and spring grassland; pay attention to the relevant technical measures to the adaptability of the scale of the pastoral environment in the designing process. Also, pay attention to the regulation of grassland circulation: on one hand, to guide the grassland to the larger business subject reasonable and orderly circulation; on the other hand, beware of the herders who transfer to the pastures to transfer the grazing pressure to the flowing pastures.

### **8.3.4 Recommendations for free consultation and open information**

In order to enable the project to be implemented smoothly and effectively, the relevant information of the project needs to be made known to the public from the provincial, county, town, village, social and other levels, such as notice, notice, discussion and in-depth interview, and to carry out the project in an open, transparent and voluntary manner in order to gain public trust and support. Relevant compensation standards, funds and forms of compensation

relating to restricted access should be fully and freely consulted with the affected population, to understand and fully take into account their aspirations, to respect the traditions and religious customs of the peoples involved and to address in a manner acceptable to the relevant issues involved in the implementation of the project. There is also a need to establish complaints committees at all levels prior to the start of the project to receive, assess and mediate complaints and grievances that may arise within ethnic minority groups.

The above recommendations are one-to-one with the social risks mentioned in the previous article, aimed at resolving social risks, promoting the smooth implementation of the project, and in the process of making the recommendations, taking into account the operability of the recommendations and respecting local culture and customs, guaranteeing the local people's right to know, to a certain extent to ensure the follow-up implementation of the project.

# Chapter 9 Environmental Management Plan

## 9.1 Environmental Management Organization and Responsibilities

### 9.1.1 Organization and Responsibilities

The project is funded by GEF financing. The World Bank is the implementing agency, and the Agricultural Ecology and Resource Conservation Station of the MOA is responsible for the specific implementation management, the establishment of the Project Management Office (PMO), and the appointment of a Chief Technical Adviser to provide technical support to PMO. For the management and implementation of the project, the Agricultural Ecology and Resource Protection Station organizes and negotiates various stakeholders, and establishes provincial and county project leading groups and project management offices, as well as national and provincial project expert groups.

**Project Steering Committee:** led by the Agricultural Ecology and Resource Protection Station of the MOA and served as the director of the Steering Committee. The member units include the Ministry of Finance, the Ministry of Science and Technology, the Ministry of Environmental Protection, and the Women's Federation. The committee holds a meeting in Beijing every year to listen to the project progress report, review the next annual work plan, and review important adjustments in the implementation of the project.

**National Project Director (NPD):** The National Project Director is responsible for project implementation on behalf of the MOA. The NPD is the key responsible party for project implementation and will ensure that all project commitments committed by the government are put in place on time. The NPD will also approve the recruitment of personnel, prepayment of project funds and financial reports.

**National Project Management Office (NPMO):** Under the leadership of NPD, the project office is responsible for handling the day-to-day administrative management of the project implementation process, supervising the implementation of project subcontracting and agreement activities, and coordinating various stakeholders. At the same time, the project office will submit project reports in accordance with the requirements of the GEF and WB; accept the audit of the National Audit Office and the assessments of the GEF and WB organizations. The project office will also be responsible for coordinating the implementation of the national supporting funds and supporting projects. The director of the project office is concurrently appointed by NPD, with 3 deputy directors. Other key members include procurement officers, finance and project assistants.

**Project Chief Technical Consultant:** Mainly responsible for professional consultation

on technical issues arising in the implementation of various parts of the project, and the design and effectiveness evaluation of the project implementation plan. Assist the project office to draft a project progress report. Participate in the formulation of project work plans, subcontract work tasks, etc.

**Provincial Project Steering Committee:** The Provincial Agricultural Department (Agriculture Committee) organizes the establishment of a leading group, with the deputy director (deputy director) in charge of agriculture as the leader of the leading group, and other relevant business departments of the province, such as the Science and Technology Department, the Poverty Alleviation Office, and the Finance Department and other departments. The main responsibilities are to coordinate and supervise the implementation of project activities in the province, to ensure that the commitments and contributions of the commitments are implemented as planned, and to effectively implement, publicize and promote the policies, measures and activities of the project. The office under the leading group is responsible for the daily coordination and management of the project in the province.

**County-level project steering committee:** The county government set up a project leading group, and the deputy magistrate in charge of agriculture served as the leader of the leading group. The main responsibilities are to coordinate and supervise the implementation of project activities on the local level, to ensure that the commitments and contributions of the commitments are implemented as planned, and to effectively implement, publicize and promote the policies, measures and activities proposed in the project.

**County-level project management office:** The county-level project leadership group has a county project office. The county agriculture and animal husbandry department is the lead unit responsible for coordinating and implementing the decisions made by the leading group. It is responsible for supervising and coordinating the implementation of the local activities of the project. And give necessary support to implement the promised local supporting funds and supporting projects as planned.

**National expert group:** The national project management office has a team of experts, led by the project's chief technical consultant, to organize experts in the fields of grassland, animal husbandry, plant protection, information management, to provide technical support and consultation for project implementation.

**Provincial expert group:** set up a team of experts in the province, cooperate with the national expert group, and be responsible for providing technical support and technical consultation for project implementation in this province.

### **9.1.2 Project Monitoring and Evaluation**

Monitoring and evaluating project implementation processes and results in accordance

with current regulations of the World Bank, the GEF, and the Chinese government. The monitoring and evaluation is divided into two parts, the internal self-assessment and the external supervision evaluation. The National Project Office is responsible for the internal supervision and evaluation of the project. The project regularly submits implementation reports through monitoring and evaluation of national, local and various undertaking units, and invites experts in relevant fields to carry out project monitoring and evaluation. During the implementation of the project, the implementing agency of the project needs to submit the project semi-annual progress report, annual report and project implementation review report according to the requirements of the World Bank and the GEF. According to the project work plan and the evaluation index system of project results, the report should give a comprehensive introduction to the project achievements, project progress, whether to adjust the original plan, the problems encountered in the implementation process and the measures to solve the problems during the reporting period. The National Project Office reports annually to the Project Steering Committee on the progress and achievements of the project, submits the annual work plan, and adjusts and modifies the work plan and budget in accordance with the recommendations and decisions of the Project Steering Committee.

The external monitoring and evaluation of the project is carried out by the World Bank and the GEF. The main activities include annual monitoring projects, mid-term evaluation, final evaluation and follow-up evaluation. The project mid-term evaluation plan is carried out in the first quarter of the third year of project implementation, and the final evaluation of the project is carried out at the end of the project. The final report of the project should be completed before the end of the project, and the results and lessons learned from the project should be systematically summarized. The World Bank and the GEF can also organize a review of the project after the project is completed based on the completion of the project.

Mid-term and final evaluation can be conducted in different formats, such as audit reports, conference discussions and interviews, field trips, and more. The experience needs to be fully summed up in the assessment. When it is found to be insufficient, propose rectification opinions, and improve the project plan and adjust the project activities. Promote the achievement of project objectives. In the process of assessment, recommendations for project sustainability are needed. The project will also receive an annual audit from the National Audit Office.

All evaluation reports are posted on the project management website. Various promotional activities are also instantly shared on the project management website during the project implementation process.

### 9.1.3 Consulting and guidance on technology in the project area

According to the needs of the overall objectives of the project, the main content of the technical demonstration, combined with the actual production problems in the project area, is to set up a project expert group, hire the project chief experts, and hire the project grass and animal husbandry production technology experts and project information management experts. At the same time, according to the technical consultation and guidance needs of the demonstration area, an ecological expert is hired to set up an expert group at the demonstration site to guide the demonstration and promotion of new technologies.

#### (1) Consulting and guidance on technology in the project area

**Chief Expert of the project:** 1 chief expert in the field of climate-smart agriculture will be hired to response for technical guidance of the project and technical consulting for project implementation, who will work 75 days a year, 5 years for a total of 375 days, and 2480 yuan (\$400) per day, including labor and work expenses, totaling 9.3 million yuan (\$150,000).

**Eco-experts:** In the implementation process of the project, eco-experts are hired according to the needs of specific activities of technical consultation and guidance, and are responsible for the guidance and training of ecological technology in the project, and participate in technical monitoring and evaluation of the project. Working 30 days a year, 5 years working for 150 people·day, 2480 yuan (\$400) per day, including labor and work expenses, totaling 372,000 yuan (\$60,000).

#### (2) Establish a technology promotion platform for grass husbandry

For the technical promotion needs of the project, it will establish a technical training and promotion platform at different levels of the administrative village-town-county, and improve the training facilities and other related hardware facilities. It also will form an excellent and stable training team, and employ technical training experts and teams in different fields to provide teacher protection for technical training promotion, and compile relevant training materials and establish a technical training website, and translate relevant textbooks and websites, and establish a bilingual training system for Chinese and Tibetan. Through the above activities, it will provide a platform for the popularization and promotion of new technologies and models.

#### (3) Developing community capacity building in pastoral community

According to the characteristics of the natural conditions of the pastoral community, the community personnel training with the mutual aid group and the natural village as the core will be carried out and the prominent roles of community backbone, village-level scientific and technological service personnel and community households should be emphasized. The learning and training model is attended by technical experts, pastoralists, and village and

town staff. Regular professional skills training is provided to guide pasture production techniques and livestock management.

The grassroots agricultural technology extension personnel shall be selected to participate in the training of industrial classes in the province, or to observe and exchange with other counties and districts and typical towns and villages, and agricultural technicians will be selected to participate in the training of the inspection classes outside the province. Through the implementation of the project, the overall utilization level of grassland management in agriculture and animal husbandry communities will be improved, the skills of farmers and herders will be improved, the transformation of scientific and cultural quality and business thinking will be promoted, and the promotion and application of new technologies and new varieties of agriculture will be promoted, conversion rate of agricultural technology will be increased. It will provide strong talent support for the development of agriculture and animal husbandry and the construction of new rural pastoral community.

#### **9.1.4 Technical exchange and discussion**

(1) Conducting technology popularization activities. Organize technicians and pastoral representatives from other townships in the project counties to conduct on-site study in the project area. The project area will issue a specific technical printed manual to the learners. According to this model, the formation of innovative technologies can be promoted in the project townships and towns, and then spread to other townships and towns in the project counties as well as other provinces and cities. At the same time, the personnel involved in the project area will be arranged to conduct technical exchanges and study outside the project area, and spread knowledge and technology on ecological protection and carbon sequestration in domestic pastoral areas, and carry out relevant science education activities.

(2) Seminars and exchanges at home and abroad. Analyze and discuss the results of the demonstration project, and publicize the demonstration projects implemented through appropriate media methods and disseminate the results and lessons learned from the project. It will organize international exchange conferences or domestic seminars, and invite relevant experts and scholars at home and abroad to participate.

## **9.2 Potential environmental impacts and mitigation measures**

### **9.2.1 Environmental impact during the construction period**

**The environmental impact during the construction period comes from:**

(1) Reinforcement of grassland fences

The main sources of air pollution are: during the construction period, dust may

occasionally be generated, and the exhaust gas generated by vehicles transporting materials for fences may have a certain impact on the atmospheric environment around the construction site; In the construction process, if the original fence is removed and cleaned, it will also produce dust, causing a certain adverse impact on the atmospheric environment. Therefore, construction dust, vehicle exhaust will pollute the construction scope and the length range of surrounding road.

Water pollution mainly includes: construction and production waste water and workers' domestic sewage. The construction of the fence strengthening activity does not produce waste water. The domestic sewage mainly belongs to the construction workers, all of whom belong to the local residents, so it only involves the construction workers' catering and excrement sewage.

The main sources of noise during construction are construction noise and motor vehicles.

During the construction time, the main sources of solid waste include: construction waste and household waste, etc., mainly from the demolition and replacement of debris involved in the fence reinforcement, and household waste of construction workers.

#### (2) Reseeding on grassland

This project adopts reseed fill no-till seeding machine to seed. In the process of mechanical no-tillage reseeded, soil surface crushing, sowing, fertilization and soil re-coverage compaction are completed at same time, and the impact on grassland is minimized. The compaction process not only avoids the loss of grass seed but also soil erosion caused by loose soil surface. The impact on the environment is relatively small, but the re-seeding of grass will impact and damage to the original soil structure and grassland vegetation, which will lead to the change of ecological structure within the re-seeding range.

#### (3) Manual planting grass

In this project, no-till is adopted for seeding. The seeding method is a drilling tillage, repression is carried out after the broadcast.

The manual planting grass project is a small project, although it will cause a certain degree of trauma to the native land, but because of the no-till method, seeds are sown and covered immediately after ditching, and the environmental impact disappears with the growth of herbage. In the planting season, the native grassland ecosystem will be disturbed to some extent.

#### (4) Activities in this project may cause hazards

- When excellent pasture is introduced into the manual grass, the economic benefits are mainly considered, and its ecological hazard may be neglected. Forage also has the characteristics of weeds, such as rapid reproduction, wide adaptability and

strong resistance. From a human perspective, the continuation of pasture under artificial habitat conditions requires human intervention, while weeds can breed and continue in the artificial habitat. If the introduced grass species can still reproduce naturally in the process of cultivation without human's cultivation process and links (human intervention), it becomes weeds, that is, the so-called wild species, which has realistic or potential danger. Moreover, the magnitude of this risk is directly proportional to the natural continuation ability of the plant in artificial habitats. The more sustainable the plants are, the more they will be in artificial habitats, the more resources and space they will invade, and the more harmful they will be to humans. If the plant directly or indirectly affects the life safety of humans and animals or has a huge impact on crops, it is even more harmful.

- Artificially planting a large area of single species of pasture will reduce community diversity and make it more susceptible to invasion by other alien species. Changes in plant communities also cause changes in ecological processes, such as normal changes in the fire cycle, and increase the frequency of fires.
- Invasive organisms brought by pasture introduction include not only pasture, but also dangerous insects and microorganisms that may be carried by pasture, which are concealed.
- Oats are annual high-quality grasses, which are more resistant to poorness, cold and drought, and oat seed species may be mixed with wild oats, which are cosmic weeds worldwide.
- Foreign species (grass) introduce exotic species.

**The environmental impact during the operation period comes from:**

In the technical part of the project, the grassland yield is increased by means of grassland reseeding and manual grass planting. At the same time, the livestock stocking system is implemented to reduce the carrying capacity of grassland. This will restore the pastures in the project area and increase the vegetation coverage. Combine the biological management of rats and insects to reduce the amount of pesticides used. The restoration of pastures will also reduce the occurrence of rodents. The implementation of the project can promote the benign development and restoration of grassland and promote the sustainable development of grassland ecosystem. With the restoration of grassland, it can also reduce soil erosion, conserve water and protect wetlands, and contribute to the protection of the source water of the Yangtze and Yellow Rivers. Therefore, the environmental impact during the operation period is a good aspect.

(1) Manual planting grass

The environmental impact of manual planting grass mainly includes tillage and manual

grassland cultivation. The manual grass sowing will affect a small range of biodiversity.

The main measures include: In manual grassland cultivation, use organic fertilizers produced from local livestock as much as possible, and avoid the impact of chemical fertilizers on soil structure and properties.

The selected land is mainly the livestock sleeping circle, and the grass seed is selected as the local dominant herbage as the manual planting grass species. As long as the management is strengthened, the project implementation will not have a great impact on the environment of the project area, which is acceptable.

#### (2) Pest control and prevention technology

For pest control in the project area, 1.2% nicotine and matrine are used as insecticides to spray in the harmful area, after spraying, grazing is banned for 15 days. The matrine is a plant-derived pesticide, the residue in different objects and soil is lower than the national standard, so there is no residual problem. Low dosage, which is easy to get degradation in the environment, in nature it also can be rapidly decomposed, the final products are carbon dioxide and water, and it have no pollution to the environment.

Using physical and pesticide control for rodent, D-type Clostridium botulinum toxin, no pollution of the environment, even safety to human and animal. The two kind of pesticide belongs to U Hazard Class.

#### (3) Efficient breeding technology of Tibetan sheep and yak

The environmental impacts of Tibetan sheep and yak breeding mainly include odor, excrement and urine, and animal and poultry epidemic prevention.

In this project, the enclosure feeding in the local area was open, with good air circulation, which was naturally discharged into the air. Because it is herdsman scattered breeding, the environmental impact is very small. There is no large number of residents in the surrounding areas, only farmers and herdsmen live nearby, which will not affect the residents.

The foreign feed (forage) purchase may bring invasive alien species.

### **9.2.2 Mitigation measures of environment impacts**

#### **The mitigation measures during the construction period:**

##### (1) Dust pollution control

The closer to the construction site, the greater the concentration of dust in the air will be. Since the project is fence-reinforced, the amount of work is very scattered and the length involved is long. However, the amount of work in each construction area is small. In addition to being on vast grassland and has little impact on the environment. If the local area involves dismantling or a large amount of work, sprinkler measures can be taken at the construction site to reduce the dust concentration at the construction site. Minimize the impact of dust

generated during construction on the surrounding environment. If it is removed, it is recommended to remove the removed materials as soon as possible to avoid stacking affecting the environment. Considering that construction, material transportation and loading and unloading are all phased operations. With the end of the construction, the impact of dust on the surrounding atmospheric environment will also end.

Manual planting grass and grassland reseeded: dust will be generated in ditching. After ditching, seeding and soil covering will be completed together, with a small amount of production, and it is located in wide grassland, and its impact on the environment is acceptable. It is suggested that the manual planting grass should be carried out in sections, and the furrows, seeds and soil covering should be completed at the same time to minimize the impact. And reseeded should be carried out separately to avoid one-time planting in large area. With the end of planting, the impact of dust on the surrounding atmosphere also ends.

#### (2) Water pollution control

The domestic sewage in this project mainly comes from the construction workers, and most of them belong to local residents. If the construction area is far away from the residential area, its catering and fecal sewage should be abandoned away from the water source. Avoid contaminating nearby water bodies. The domestic sewage of this project is limited to the construction period and the relative time is short. After the above water treatment measures, the influence of construction domestic sewage on the surrounding water environment can be effectively prevented.

#### (3) Noise pollution control

Construction noise generally affects the acoustic environment of sensitive points such as villages within 200m along the line. Some transport vehicles will have a certain impact on the residential area near the embankment. Due to its vast grassland, it is not sensitive to environmental impacts, and only areas adjacent to the home will have an impact. It is recommended to control construction time in these areas. The project is limited to construction during the day and avoids lunch breaks (12:00~14:00). Ensure that the noise value at the noise sensitive target meets the requirements of the Acoustic Environmental Quality Standard (GB3096-2008).

#### (4) Waste control

The solid waste generated during the construction period is mainly the material waste and domestic garbage that may be replaced during the fence reinforcement process. Material waste and domestic garbage should be stored separately. Material waste should be cleaned up and disposed of in time, and domestic garbage should be taken back to the living area for treatment.

#### (5) Ecological impact control

During the construction period, the grassland vegetation within the construction area may be damaged and the soil erosion will be aggravated. Therefore, during the construction period, the rainy season (May-August) should be avoided to reduce soil erosion.

During the sowing of herbage, should avoid the early dry season in spring. In the process of no-tillage reseeding, the process of sod cutting, soil loosening, reseeding and covering is adopted to reduce soil disturbance and soil erosion, and at the same time, it can better retain heat, retain moisture and resist drought, and promote the grass growth. According to the topography, the zoning of planting grass was carried out, and adopts measures according to local conditions and implement them step by step.

**The mitigation measures during the operation period:**

(1) Artificial planting of grass

In manual grassland cultivation, use organic fertilizers produced from local livestock as much as possible, and avoid the impact of chemical fertilizers on soil structure and properties. The selected land is mainly the livestock sleeping circle, hay is mowed in autumn. As long as the management is strengthened, the project implementation will not have a great impact on the environment of the project area, which is acceptable.

The grass seed is selected as the local dominant herbage as the manual planting grass species. The grass species are cultivated and domesticated into local fine forage species, and their cultivation will not cause the invasion of alien species.

In order to avoid the inconsistency of grass seeds quality, or the introduction of weed seeds by unscrupulous merchants, the project purchases high-quality forage seeds through open tendering to control seeds quality to meet the requirements of Grade 3 and above specified in GB 6142. The planting area of the project will supply seeds and will be guided the key steps of technology such as: the plant, management, harvesting and utilization of manual grassland to ensure the supply of high-quality forage materials for the livestock feed of the project.

If found that wild oats are mixed, the wild oat seeds in the seeds can be picked and throw away by Crop rotation, or the wild oats can be germinated by shallow tillage before planting in the oats, then kill the whole grass by chemical herbicides, and then planted.

(2) Pest control and prevention technology

The project combines artificial killing and biological control, popularizes biological control technology and comprehensive technology and reduces the loss to the range of ecological threshold.

This activity is in line with the co-financing of the project currently being implemented. The combination of bio-control and artificial killing is carried out, and biological control technologies and comprehensive development and utilization technologies are actively

promoted to reduce disaster losses to ecological thresholds. Density survey is carried out before the prevention, and each work area is set up with 3 samples and a total of 6 samples are taken. Using a square sampling method, the sample area is 1/4 hectare. First count the number of mounds in the sample, and then dig the fresh mound in the sample to open the tunnel. Those who have sealed the hole will catch it and catch it for 3 days, and check at least 2-3 times a day. Control effect (%) = number of effective mounds before prevention - effective number of mounds after prevention / number of effective mounds before prevention × 100%.

According to the results of the previous density survey, technical measures for rats and pests are implemented. The specific method is to place the bait at 7 to 10 cm from the effective hole, and the hole rate is over 90%. In addition, in the area where the density of the rats is large and the distribution is uniform, the strip-shaped feeding is used, and poison bait is evenly applied every 10 m. After the bait, the grazing is prohibited for 8 to 10 days. When putting the bait, it is required to be a group of 20 to 30 people, and each of the two putting personnel is separated by 2 to 3 m. Putting is synchronized in the same direction. After a large area of poison bait is released, if special weather such as strong winds or snowfall is encountered, the control effect will be affected. At that time, the poison bait must be added. Before placing the bait, all the herders in the prevention and control area should be notified in time, and the livestock should be transferred to the pastures outside the control area for grazing. The control area prohibits grazing within 8-10 days after the poison bait is placed to prevent accidents. The rate of decline of rats and insects will be checked within 5-7 days after prevention.

The project combines artificial killing and biological control. Under the No-till seeding, Spring-forbidden grazing, the increase of grassland coverage and the increase of biomass in the above ground part of grassland, are disadvantageous to the survival of rodent, this can restrain the rodent damage.

Under the No-till seeding, Spring-forbidden grazing, the increase of grassland coverage, are disadvantageous to the survival of rodent, and finally using low toxic biological pesticides to minimize the impact on the environment.

### (3) Efficient breeding technology of Tibetan sheep and yak

In this project, the nutritional structure and feed composition of the original livestock and the source of the pasture are not changed to prevent the risk of invasion by foreign feed (forage) purchase.

In this project, the enclosure feeding in the local area was open, with good air circulation, which was naturally discharged into the air. Because it is herdsman scattered breeding, the environmental impact is very small. There is no large number of residents in the surrounding

areas, only farmers and herdsmen live nearby, which will not affect the residents.

Estimated Moeller Town cow and sheep manure can be treated and applied as resources, fertilizer utilization. The manure is collected and stacked in the yard of herdsmen for air drying. In winter, it can be used as heating material according to the habit of herdsmen, the rest can be compost as organic fertilizer, apply organic fertilizer to manual planting grass in spring every year as fertilizer, instead of chemical fertilizer, reduce the impact of chemical fertilizer on the environment, at the same time to cultivate soil; extra organic manure can be applied to pasture.

It was calculated that if all the manure was returned to the field as fertilizer, the nitrogen application amount could reach 10.16 kg/hm<sup>2</sup>, the application amount of phosphorus can reach 1.67 kg /hm<sup>2</sup>, is below the threshold value.

#### Epidemic prevention measures in the project area

Veterinary stations are especially responsible for epidemic prevention in the project area, the responsibility system for epidemic prevention and control is implemented, both administrative and professional work responsibilities are taken at the same time, administrative for density control, professional work for quality. Every township in Moeller Town has animal husbandry and veterinary station, which has fixed funds. Animal husbandry and veterinary station collects and hires vehicles to carry out for harmless treatment when the animals died of diseases are reported to the herdsmen. The treatment mode is deep burial, and the location is chosen to be far away from the water source to avoid contamination of surface water and groundwater.

According to the ministry of agriculture “Technical Specification for the Harmless Treatment of Dead and Diseased Animals” notice:

Site selection requirements: should choose dry terrain, and in the downwind location; stay away from schools, public places, residential areas, villages, animal feeding and slaughtering sites, drinking water sources, rivers and other areas.

Technology: the volume of the buried body is determined by the actual animal carcasses and the related animal products quantity. The bottom of the deep pit should be more than 1.5m above the Groundwater level, need to Anti-seepage and anti-leakage; put a layer of quick lime or bleaching powder with a thickness of 2-5cm at the bottom of the pit. Put animal carcasses and related animal products into the pit, the top layer more than 1.5m away from the surface, disinfectant such as quick lime or bleaching powder, cover the soil 20-30cm from the surface with a thickness of no less than 1-1.2m.

Operation attention: the soil can't be too hard by burying to let gas bubbles emissions and liquid leakage caused by corruption. After deep burial, a warning mark shall be set up at the site of deep burial. After deep burial, the inspection shall be once a day in the first week,

once a week in the second week and continuously for 3 months, and the collapse place of the deep pit should be covered with soil in time. After deep burial, immediately use chlorine preparation, bleach powder or quick lime and other disinfectants to thoroughly disinfect at once. The first week should be disinfected once a day; the second week should be disinfected once a week, continuous disinfection for more than three weeks.

#### (4) Biological invasion environment prevention and cure measures

The grass species selected for no-tillage reseeding in the project are: in the natural grass group, the perennial grass undergraduate excellent forage grass species suitable for growing in the Qilian Mountains, *Elymus nutans*, Qinghai Chinese fescue, and Qinghai grass *Poa pratensis*. All three kinds of grass species are belong to the local wild species category. After cultivation and domestication, they finally have become local fine forage grass species, and the wide ranges of cultivation are not able to cause the invasion of alien species.

The manual planting grassland select Qingyin No.1, Qingyin No.2 and Qinghai444, and the fine bean grass *Vicia sativa*. After cultivation and domestication, they finally have become local fine forage grass species, and the wide ranges of cultivation are not able to cause the invasion of alien species.

Purchase of grass species:In order to avoid the inconsistency of grass seeds quality, or the introduction of weed seeds by unscrupulous merchants, the project purchases high-quality forage seeds through open tendering to control seeds quality to meet the requirements of Grade 3 and above specified in GB 6142. The planting area of the project will supply seeds and will be guided the key steps of technology such as: the plant, management, harvesting and utilization of manual grassland to ensure the supply of high-quality forage materials for the livestock feed of the project.

Grass species control:The project need to select grassland no-tillage reseeding agricultural companys with a certain scale of qualification, and organize the implementation of no-tillage reseeding based on the village-level government in the project area.At present, no-tillage seeding and manual planting grass have been carried out for many years in the project area. There is no invasion of alien species, So there is almost no harm to alien invasion in the project area.

Supervision for the foreign feed (forage) purchase:After many years of the foreign feed (forage) purchase in this region, no damage has been found in the project area, so the risk of alien invasion is very small for the foreign feed (forage) purchase may happen in the project area. In this project, the nutritional structure and feed composition of the original livestock and the source of the pasture are not changed to avoid the risk of alien invasion.

If found that wild oats are mixed, the wild oat seeds in the seeds can be picked and throw away by Crop rotation, or the wild oats can be germinated by shallow tillage before

planting in the oats, then kill the whole grass by chemical herbicides, and then planted.

In Qilian Mountain National Park Reserv, there are many kinds of wild animals, including more than 20 species such as wild yaks, wild donkeys, white-lipped deers, snow leopards and bears.

As shown in the 4.1 project location, the project area is not within the protected area, and the project activities will not affect wildlife. During the investigation, the herdsmen reported that there were some wild animals in the mountain protection area. When the food is shortage, the wild animals would occasionally go down to herdsmen's pasture to forage. Most of them are wolves, which caused losses to the herdsmen's livestock in the project area. All herdsmen know that wildlife should be protected, and the forest public security and insurance compensate for the casualties of wildlife in pastoral areas when herdsmen's livestock are killed or injured by wild animals.

### **9.2.3 Suggestions and Measures for Public Participation**

Suggestion summary is following:

(1)The households in the project area hope to participate in the project enthusiastically, and promote the implementation of the project as soon as possible, and hope the project benefits to the households.

(2)The main problems of farmers in production are: the rodent and pests problem are serious in the project area; inadequate numbers of staff, lack of technical personnel and relevant training, lack of personal protective goods; a dearth of infrastructure, low utilization rate of greenhouse, low forage yield, lack of processing machinery and other ancillary facilities; the Storage tanks freeze in winter.

(3)The most of population in the project areas are ethnic minorities.

(4) Wild animals near the project area occasionally go to the pastoral area to hunt and breed livestock, most of which are caused by wolves.The livestock loss caused by wildlife will be compensated by forest public security and insurance together, but the compensation price is still lower than the market price.

(5)Farmers in the project area have a strong ability to accept advanced technologies, and some farmers have rich planting experience, which can ensure the implementation of the project.

According to project area farmers' demands and concerns, the project carries out the relevant design:

(1)The goal is to increase grassland productivity by 20%~30% in the project area. The biodiversity of grassland is to be maintained through the regulation of seasonal forbidden grazing and grazing pressure. The efficiency of livestock production can be increased by 30%

and the income of herdsmen can be increased by 10%~15%. Manual planting grass can ensure the supply of forage in non-growing seasons and improve the ability of grass husbandry to resist natural disasters and climate change.

(2)Manual planting grass can ensure the supply of forage in non-growing seasons and improve the ability of grass husbandry to resist natural disasters and climate change. Manual planting grass can also full use the livestock manure as organic fertilizer, avoiding the use of chemical fertilizers.

(3)Improve the production and management level of herdsmen's grass husbandry through technical services and training.

(4)Realize the coordinated development of the human - grass - livestock system; carry out activities such as innovation and application of relevant supporting policies, expansion and promotion of public knowledge, and establish a climate smart grassland ecosystem management system through technology demonstration and application, policy innovation and new knowledge popularization, enhance the adaptability of grassland production to climate change, and improve carbon sequestration and mitigation capacity of grassland system in China.

(5)In order to improve the quality of grassland and improve the capacity of livestock per unit area of grassland, the project is going to implement no-tillage reseeding. Protect the grassland and improve the efficiency of animal husbandry by Spring-forbidden grazing and change the grazing habit of herdsmen. The manual planting grass supplements to regulate the nutrition of livestock and provide nutritive and reasonable forage for forbidden grazing period, in order to reduce the carrying capacity of livestock in the pasture and improve the quality of the pasture. It could prevent and control pests and rats comprehensively.

#### **9.2.4 The mitigation measures of social impact**

(1) If the project can be implemented smoothly according to the planned plan, it is expected to bring about the following social impacts

**Change herders' traditional grazing habits to make animal husbandry more intensive and efficient:** The implementation of the project will help change the habits of herders grazing on natural grass all year round. Natural grassland management activities such as spring rest grazing, captive feeding, and manual planting grass cannot only restore grassland in key periods such as grass germination and seed maturity, but also reduce the fat loss of livestock to a certain extent. Optimized forage can also help to adjust the nutritional structure of livestock, so as to make animal husbandry more intensive and efficient.

**Change herders' concept of ecological compensation and encourage them to voluntarily protect grassland resources:**The existing ecological compensation policy in the

project area is distributed to the herders according to the grassland area contracted by the herders' families and the criteria of forbidding grazing and grassland-livestock balance. The empirical grassland ecological compensation policy implemented by the project will strictly implement the ecological compensation policy in accordance with the approved livestock carrying standard, that is, the participating households will be compensated for the losses caused by reduced livestock, and to reward the ecological products brought about by the protection of grassland. Through the implementation of the project for many years and its demonstration effect, the herders' concept of compensation is improved, so that herders can voluntarily protect grassland resources under the new ecological compensation mechanism.

**Enhance herders' ability to accept new technologies and improve their sustainable livelihoods:** During the implementation and demonstration, the project will provide consultation and guidance on animal husbandry technology, and use the agricultural technology promotion platform and the Agricultural Broadcasting School to train new types of professional farmers and herders, improve the technical acceptance of herders, enhance their human capital, broaden their livelihood strategies, and then improve herders' sustainable livelihood level. The adoption of new animal husbandry technology by project participants and the improvement of their livelihood level can also promote the adoption of technology and livelihood improvement of pastoral households in the whole project area, thus promoting the sound and rapid development of pastoral areas.

(2) Potential social risks and countermeasures of the project

- Coordination of relationship between project households, project groups, and project villages are needed
- The project area's workforce is feminized and aging seriously
- Grassland is small and fragmented, and grass circulation is common
- Village level organization
- The carrying capacity of livestock in the pasture is high, but the captive breeding rate is not high in winter
- Climate change may affect project implementation
- Grass-roots pastoral technology promotion is weak, and the technology acceptance ability of herders is weak

(3) Policy recommendations to improve the social impact of project implementation

**Suggestions on the coordination of the interests of vulnerable groups:**

For coordination of the interests of vulnerable groups, the overall principle is to ensure that their rights are not harmed and to provide them with as many development opportunities as possible, so as to help them build their capacity so that they can maintain the sustainability

of their livelihood. The coordination of interests involved in project implementation mainly includes the coordination of interests between project households, project teams and project villages and non-project households, non-project teams and non-project villages, and the relationship between vulnerable groups such as women and elderly herders and non-vulnerable groups, as well as the coordination of interests of ethnic minority groups and restricted access to groups due to projects.

For the interests of project households, project teams and village associations and non-project households, non-project groups and non-project village associations, the project office and the local government shall, according to the specific conditions of each village, establish corresponding project coordination groups and project implementation groups at the village and community levels to coordinate the allocation of project resources. On the basis of unified project planning and design, the principle and standard of project resource allocation should be clarified to avoid social conflicts caused by it, and a transparent system of project resource allocation and herders complaint mechanism should be established.

For vulnerable groups such as women and elderly herders, women's needs should be understood during the implementation of the project, gender equality should be taken into account, and women's right to participate should be guaranteed. In particular, effective project information and technical support should be provided for women. In order to ensure a smooth implementation of the project, it is necessary to provide corresponding intensive technical training to the herders, especially the elderly herders, and provide effective socialized technical services to them.

The interest groups of ethnic minorities should respect their customs and religious beliefs, give due consideration to the proportion of ethnic groups, and try their best to benefit all ethnic groups equally. For the restricted access groups involved in the project implementation, their rights and interests should be protected from the losses caused by the project implementation. They should be fully consulted and compensated in a way acceptable to them.

#### **Suggestions on the organization and capacity building of project village households:**

The organization and capacity building issues involved in the implementation of the project include the low level of organization at the village level, difficulties in the formal cooperation of herders, the weak promotion force of grass-level animal husbandry technology and the insufficient capacity to cope with climate change. In view of the low level of village-level organization and the difficulty in dealing with various risks and uncertainties in pastoral areas, we can start from two aspects: first, take corresponding measures to cultivate professional cooperatives of herders and give effective incentives; Second, encourage herders to carry out various forms of spontaneous cooperations, such as shearing sheep, shoveling

sheep manure and rubbing cow hair, and on the basis of these mutual assistance activities, adopt relevant incentive measures to cultivate the establishment and operation of professional cooperatives of herders with certain market capacity. To solve the problem of weak popularization of grass-roots animal husbandry technology, the project can be used as an opportunity to innovate the technical service mechanism and strengthen the technical service team of towns and villages. The project may allow for: establishing a rural organic integrated animal husbandry socialized technical service system, focusing on the implementation of the project; adopt effective training models and mechanisms, taking into account ethnic herdsmen, and cultivating a certain number of herders technicians and technology demonstration households, especially women; use the national agricultural technology extension service information cloud platform to provide intensive training for township and village community technicians and pastoralists. As climate change brings more rain to the project area, it is necessary to consider measures to cope with climate change such as low temperature in winter, seasonal drought in winter and spring, and concentrated precipitation in summer and autumn; Further strengthen the socialized service of livestock insurance; Farmers are encouraged to participate in policy-based insurance for natural disasters.

In short, in the long run, single-family-based livestock production will face many unfavorable factors, especially under climate change. Future pastoral development requires the development of informal mutually beneficial cooperation and more formal cooperative organizations so that livestock production can use resources more efficiently, implement more eco-friendly measures and target a broader livestock product market. The implementation of this project is expected to make a useful attempt in these areas.

#### **Suggestions on pastoral habits and grassland leasing issues:**

In view of the high load of livestock in the pastures of ethnic minority herders in the project area, and the low rate of winter captivity, it is necessary to take the project as an opportunity to guide the herders to: change the traditional way of stocking livestock; rely on the technology provided by the project to improve the quality of livestock products; and help the herders obtain the certification of high-quality livestock products, so as to improve the price and operating efficiency of livestock products. The livestock load in the pastures may thus be reduced. As for the issues of pasture fragmentation and the common but not-standard grassland circulation, the following practices may alleviate the problem: strengthen the guidance of the herders; make the project measure as far as possible to cover its contracted winter and spring grassland; pay attention to the relevant technical measures to the adaptability of the scale of the pastoral environment in the designing process. Also, pay attention to the regulation of grassland circulation: on one hand, to guide the grassland to the larger business subject reasonable and orderly circulation; on the other hand, beware of the

herders who transfer to the pastures to transfer the grazing pressure to the flowing pastures.

### **Recommendations for free consultation and open information:**

In order to enable the project to be implemented smoothly and effectively, the relevant information of the project needs to be made known to the public from the provincial, county, town, village, social and other levels, such as notice, notice, discussion and in-depth interview, and to carry out the project in an open, transparent and voluntary manner in order to gain public trust and support. Relevant compensation standards, funds and forms of compensation relating to restricted access should be fully and freely consulted with the affected population, to understand and fully take into account their aspirations, to respect the traditions and religious customs of the peoples involved and to address in a manner acceptable to the relevant issues involved in the implementation of the project. There is also a need to establish complaints committees at all levels prior to the start of the project to receive, assess and mediate complaints and grievances that may arise within ethnic minority groups.

The above recommendations are one-to-one with the social risks mentioned in the previous article, aimed at resolving social risks, promoting the smooth implementation of the project, and in the process of making the recommendations, taking into account the operability of the recommendations and respecting local culture and customs, guaranteeing the local people's right to know, to a certain extent to ensure the follow-up implementation of the project.

## **9.3 Environmental monitoring plan**

### **9.3.1 Monitoring purpose**

Environmental monitoring includes two stages: project construction and operation period. The purpose of environmental monitoring is to catch the pollution in proposed project, to know the change of environmental quality, influence boundary, and environmental quality change during operation period, and to feedback the information to the responsibilities in time, to provide scientific basis for the environmental management of the project.

### **9.3.2 Environmental monitoring content**

#### (1) The site selection of project area

Firstly, the grassland households in the protected area of Qilian Mountain National Park should be screened, and excluded from the random screening of this project, so that the demonstration sites in the protected area can be excluded, so can ensure that the project implementation site do not touch the protected area.

The land for reseeded on grassland should comply with the national and local policies

and relevant regulations on grassland restoration. The land for manual planting grass only uses the horizontal circle of each herdsman, the horizontal circle is the pasture supplied by herdsmen, which is allowed to grow herbage to support animals, the nature of the land is planned to be cultivated land and herbage is allowed to grow. Exclude other nature of grass planting.

(2) Biodiversity monitoring

Chapter 7 of the feasibility study of this project includes the contents that need to be monitored content.

(3) Invasive alien species

In the growing time of grassland, combined with the monitoring of biodiversity, the alien species of the collected sample plants were monitored and analyzed.

(4) Environmental impact of construction activities

**9.3.3 Summary of environmental monitoring**

The environmental monitoring indicators of the project are summarized in table 9-1, including monitoring categories, projects and frequency, etc.

Table 9-1 The environmental monitoring indicators and categories, projects and frequency

| category                                 | Monitoring item   | Monitoring index   | Monitoring time and frequency | Budget WB+Matching (ten thousands of dollar) | Responsibility department  |
|--|---|--|-------------------------------|--|--|
| Site selection for grass reseeded        | Degree of grassland degradation   | The grassland coverage   | Before the activities         | -  | Agriculture and Animal Husbandry Bureau of County                            |
|  | The location to the reserve area  | Geographical location map of grassland   | Before the activities         | -  | Administration of the Qilian Mountain National Park                          |
| Site selection for manual planting grass | Make sure whether it is the range of livestock sleeping circle                                      | the range of livestock sleeping circle   | Before the annual activities  | -  | Town PMO   |
| Biodiversity evaluation                  | Grassland diversity, Biodiversity index, the evaluation of $\alpha$ diversity and $\beta$ diversity | Remote sensing and quadrangle rules for species $SP_c$ , The number of each species $SP_n$ , coverage $C_g$ , frequency $F_g$ , height $H_g$ composition of grassland plants | Once a year (August)          | 20+50  | The biodiversity evaluation and monitoring of bidding responsible department |

|   |                                      |  |   |       |   |
|---|--------------------------------------|--|---|-------|---|
|   | Grass coverage                       | Remote sensing of grassland growth period  |   |       |   |
| Invasive species  | Invasive species                     | Identify invasive species among plant species in the sample  | Once a year (August)  |       | The biodiversity evaluation and monitoring of bidding responsible department                                |
| Grass seeds inspection, Breeding base                                 | Planting grass seeds inspection      | The clarity and quality of the grass seeds   | When purchasing grass seeds   | -     | Town PMO and the seeds of bidding responsible department  |
| Monitoring and evaluation of grassland productivity                   | Monitoring of grassland productivity | Using remote sensing image maps based on Modis measurement , monitoring grassland overall biomass $Y_T$ , main species biomass $Y_d$ , grass coverage $C_g$ and grass height $H_g$ | Once a year (August)  | 20+50 | The monitoring and evaluation of grassland productivity of bidding responsible department                   |
|   | Evaluation of grassland productivity | Using Thornth Waite Memorial model to assess the potential productivity of the grassland   | Once a year (Select May to September as the period for research and evaluation of grassland vegetation productivity.) |       |   |
| Monitoring and evaluation of grassland carbon sink emission reduction | Soil organic carbon pool             | Aboveground and underground biomass, litter, dead wood and soil organic carbon   | Once a year (August)  | 20+50 | The monitoring and evaluation of grassland carbon sink emission reduction of bidding responsible department |
|   | Sources of greenhouse gas emissions  | Grassland direct discharge, agricultural machinery and tools use, manure management, ruminant intestinal fermentation emissions  |   |       |   |

|  |   |   |         |  |  |
|--|---|---|---------|--|--|
|  |   | reduction   |         |  |  |
| Social impact monitoring and evaluation        | Livestock status of pastoral households                           | animal husbandry production inputs, fixed inputs such as wells, fences, sheds, variable inputs such as labor, forage, veterinary veterinary drugs and machinery; animal husbandry output, livestock product output, price and sales | 12.5+30 | The social impact monitoring and pre-evaluation of bidding responsible department    |  |
|  | Grassland and its transfer  | Grassland and its transfer area   |         |  |  |
|  | Grassland ecological subsidies and reward policy                  | implementation situation  |         |  |  |
|  | Demand for animal husbandry technology                            | Acceptance of social services   |         |  |  |
|  | The livelihood status of women, the elderly and ethnic minorities |   |         |  |  |
|  | Pastoral grassland management                                     | Knowledge, attitude and behavior  |         |  |  |
|  | Project implementation  | Improvement and problems  |         |  |  |
| Environmental impact monitoring and evaluation | Physical index  | Fertilizer savings (increased livestock production, increased animal manure, which increases the amount of organic fertilizer and reduces fertilizer use), Pesticide savings  | 12.5+30 | The environmental impact monitoring and evaluation of bidding responsible department |  |
|  | Environment index   | Quality of surface water , groundwater, soil .Improved adaptability to pests and rats.  |         |  |  |

|                 |   |   |                            |        |   |
|-----------------|---|---|----------------------------|--------|---|
|                 |   | Grassland ecological environment status index   |                            |        |   |
|                 | Institutional mechanisms  | Environmental awareness training.<br>Promotion of environmental protection technology.<br>Environmental protection capacity improvement   |                            |        |   |
| Training        | technology popularization activities  | Planting technology, breeding technology, rest grazing management, technology popularization, wild oats identification, etc.  | Three or four times a year | 4.5+45 | The training of bidding responsible department and project specialists  |
| Pest monitoring | The occurrence of diseases, insect pests and mice in natural and manual planting grassland of demonstration households.<br>The occurrence of diseases, insect pests and mice in natural and manual planting grassland of check households | Pesticide use mode; Number of pesticide applications per year; Types and quantities of pesticides used annually; The cost of pesticides per acre; The number of farmers who use procedures for safe handling and application of pesticides (e.g. safe storage, protective clothing, etc.) | Once a year                | 13.11  | Plant Protection and Inspection Stations will be responsible for the guidance, inspection, monitoring and training of PMP; Together with the project implementation personnel, they are responsible for detection and reporting of pest situation in time and implementing pest management plan as required |

## 9.4 Environmental management plan

### 9.4.1 Environmental management training

#### (1) Training purpose

The purpose of environmental management training is to ensure the smooth and

effective implementation of environmental management work, make relevant personnel familiar with the content and procedures of environmental management, improve the environmental management ability of environmental management personnel, and ensure the effective implementation of environmental protection measures. For the main targets of environmental capacity building are environmental managers and supervisors, training is one of the technical support components of the project. The training course also trains the constructors and herdsman during the implementation of the project. Prior to the construction of the project, all construction units, operating units and building supervisors are required to participate in mandatory environmental, health and safety training.

#### (2) Training objects

The training objects are: all staff, project owners, all staff of environmental supervision, representatives of environmental monitoring organizations, representatives of major contractors, etc. of environmental management offices at provincial and county levels,

#### (3) Training content

The training shall be conducted one year before the implementation of the project by the project department in the form of full-time environmental management personnel, coordinators, environmental supervision engineers and other relevant personnel, and shall be carried out by environmental technical experts.

#### (4) Personnel training plan

Technical training is provided in the project, meanwhile, environmental protection training is conducted in combination with the project, and financial support is provided in the project.

### 9.4.2 Monitoring and evaluation

In order to standardize the carbon sink measurement and monitoring methods of the project, to ensure that the carbon sink emission reduction generated by the project is measurable, reportable and verifiable, a detailed monitoring and evaluation plan needs to be specified. The monitoring of this project consists of 5 parts:

**Monitoring and evaluation of grassland productivity:** The aboveground biomass and cultivated grassland yield of natural grassland are evaluated and measured in stages in the early, middle and late stages of project implementation. The total funding is 200,000 US dollars.

**Biodiversity Monitoring and Evaluation:** Grassland vegetation productivity and biodiversity in the project area are assessed and measured in stages in the early, middle and late stages of project implementation. The total funding is 220,000 US dollars;

**Carbon sink and emission reduction monitoring and evaluation:** Assessing and

measuring the soil carbon sequestration and livestock greenhouse gas emission reduction in the project area, with a total funding of 200,000 US dollars;

**Social impact monitoring and evaluation:** Monitoring the implementation of the security policy in the project area, monitoring and evaluation of output, income, etc., with a total funding of 100,000 US dollars;

**Monitoring and evaluation of environmental benefits:** Carrying out monitoring and evaluation of environmental cost-effectiveness and adaptability in the project area, including the monitoring and evaluation of surface water quality, monitoring and evaluation of rats and pest management in the project area, monitoring and evaluation of pesticide application effects, with a total funding of 90,000 US dollars.

### **9.4.3 Environmental management complaints and feedback**

#### (1) Sustained public participation

During the evaluation of the environmental and social impact of the project, residents' opinions can be collected through holding symposiums, herdsmen's surveys, visiting and posting announcements. The public can report their opinions through symposiums, or put forward opinions by writing, calling, faxing and sending e-mails to the construction units or evaluation units; also through the project county environmental protection bureau, letters and visits office to express opinions.

During the construction period or operation period of the project, the public may send comments to the construction unit or the construction unit through letters, telephone calls, faxes, emails, etc., also through the project county (city) environmental protection bureau, letters and visits office to express opinions.

After receiving the environmental protection complaint or rectification notice from the administrative department, the EIA unit, the construction unit, the establishment unit and the operating unit shall organize visits and investigations together with the relevant departments such as the design department immediately, and make rectification according to the actual situation, and publicize the rectification plan to solve environmental disputes.

#### (2) Channels for complaints and complaints

Leading group office of county and township project both accept environmental impact complaint, when the affected people in relation to any aspect of the environmental protection think their rights are violated, they can be in the form of a written or oral form to complain to the complaint acceptance office or directly to the contractor, if it is oral complaint, the complaint acceptance office members or contractors record details, and finish, then submit the processing comments within two weeks.

If the complainant is not satisfied with the opinions of the contractor or the acceptance

office, he/she may file a complaint with the relevant county or city environmental protection bureau within one month after receiving the processing comments, the relevant county and city environmental protection bureau in the statutory provisions within the time to deal with the comments.

If the complainant is still not satisfied with the opinions of the relevant county or city environmental protection bureaus, he/she may complain to the higher competent environmental protection authorities or Jiangxi provincial environmental protection bureau after receiving the opinions, or directly file a lawsuit with the local people's court according to the civil procedure law of the People's Republic of China, and the court shall adjudicate the case.

## **9.5 Feedback mechanism**

According to environmental monitoring reports and inspections by regulatory agencies, the environmental and social management plan will make targeted adjustments to mitigation measures and further improve environmental management activities.

If you found the contents of the social and environment management plan has significant deviation when checking, or changes to the project caused great adverse impact on the environment, or made by the significant rise in adverse environmental impact, project department will immediately consult environmental agencies and the world bank, and Set up an environmental assessment team to for additional environmental assessment, if necessary, additional public consultation is allowed. The revised environmental and social management plan shall also be communicated to the implementing agency and contractor to implement the revised plan.

## **9.6 Information management**

### **9.6.1 Information exchange**

Environmental management requires the necessary information exchange among different departments and positions of county and town project offices, owners, contractors and operators within the organization. Meanwhile, the organization should also report relevant information to external parties and the public.

Internal information exchange can be conducted in various ways such as meetings and internal briefings. All information exchange should be recorded and archived.

External information exchange shall be conducted once every half year or a year, and the information exchange with cooperative units shall be summarized and archived.

### **9.6.2 Information records**

In order to effectively operate the environmental management system, the owner must organize and establish a perfect record system, and keep the records in the following aspects:

- (1) Legal and regulatory requirements;
- (2) The license;
- (3) Environmental factors and related environmental impacts;
- (4) Training;
- (5) Inspection, verification and maintenance activities;
- (6) Monitoring data;
- (7) Problems in environmental management and protection;
- (8) Effectiveness of corrective and preventive measures;
- (9) Information about relevant projects;
- (10) Audit;
- (11) The review.

In addition, necessary control must be carried out on all kinds of records mentioned above, including: identification, collection, cataloging, archiving, storage, management, maintenance, inquiry, storage period, disposal and other links.

### **9.6.3 Report**

Project office, county and town in Qinghai province project leading group office, the contractor, the environmental supervision unit and project operations should conduct daily supervision and inspection for project progress, environmental measures the progress of the project implementation, training condition, environmental monitoring data and conclusion during the process of project implementation, then record and report to relevant departments.

It includes:

(1) The project environmental supervision engineer shall timely submit the project implementation status to the project owner and the project office of the town where the project is located, and the report shall include the implementation status of environmental protection measures, monitoring status and monitoring data.

(2) The owner or operator shall make detailed records of the progress and implementation of the project, and timely report the report to the project office of the town where the project is located.

(3) During the construction period, the construction unit or contractor of the town shall entrust the local monitoring station or qualified monitoring institution to conduct environmental monitoring and submit a report to the local environmental protection

department.

(4) During the operation period of the project, each project contractor shall monitor the operation of the project as required, and submit the monitoring report timely after the completion of the entrusted tasks.

(5) The project office shall timely submit the project progress report to the provincial project office.

(6) Submit project implementation reports to the bank twice a year, which may include the following main contents:

- Project progress;
- Implementation of environmental protection measures;
- Social and environmental monitoring and its main results;
- The implementation of the training plan; Continuous public participation: whether there are any public complaints, if any, recording the main contents of the complaints, solutions and public satisfaction;
- Existing problems and solutions;
- Implement the plan in the second half of the year.

Monitoring and evaluating the project implementation process and results in accordance with relevant regulations of the World Bank, GEF and the Chinese government. Monitoring and evaluation are divided into internal self-evaluation and external supervision and evaluation.

#### **9.6.4 Document management**

During the implementation of *the environmental and social management plan*, the world bank, the provincial project leading group and project management office, the project leading group and project management office of the county and town where the project is located, the EIA unit, the project supervisor and the construction unit shall manage the corresponding documents.

**Appendix**

**Climate Smart Management of Grassland  
Ecosystems Project**

**Environmental Codes of Practice**

# **1. Environmental impact of project implementation and control measures**

## **1.1 Environmental impact of during construction time**

The main environmental impact factors of the project during construction time include air pollution, water pollution, and noise pollution; waste and so on. During the construction time of this project, the activities that have an impact on the environment contain grassland fence reinforcement, no-till reseeding and manual planting grass.

### **1.1.1 Reinforcement of grassland fences**

The main sources of air pollution are: during the construction period, dust may occasionally be generated, and the exhaust gas generated by vehicles transporting materials for fences may have a certain impact on the atmospheric environment around the construction site; In the construction process, if the original fence is removed and cleaned, it will also produce dust, causing a certain adverse impact on the atmospheric environment. Therefore, construction dust, vehicle exhaust will pollute the construction scope and the length range of surrounding road.

Water pollution mainly includes: construction and production waste water and workers' domestic sewage. The construction of the fence strengthening activity does not produce waste water. The domestic sewage mainly belongs to the construction workers, all of whom belong to the local residents, so it only involves the construction workers' catering and excrement sewage.

The main sources of noise during construction are construction noise and motor vehicles.

During the construction time, the main sources of solid waste include: construction waste and household waste, etc., mainly from the demolition and replacement of debris involved in the fence reinforcement, and household waste of construction workers.

### **1.1.2 Reseeding on grassland**

Reseeding is a semi-artificial, near natural restoration measure, which refers to sowing pasture with strong adaptability and high forage value on the grassland without destroying or destroying the original vegetation, in order to increase the species composition of grassland community and increase the surface improvement, and it is also an effective measure for vegetation restoration and improvement.

This project will use no-tillage seeding to work on degraded alpine meadow. During the soil thawing period before the spring rainy season, the project will complete the ditching, sowing, covering and suppression of soil at same time, and reseed the excellent herbage, so as

to minimize the damage to the native vegetation of degraded meadow. Selecting sows in the group of natural grass is suitable for the growth of the Qilian Mountain perennial gramineous forage grass seed, selection *Elymus nutans*: Qinghai Chinese fescue: Qinghai grass *Poa pratensis* 1:1:1. The seed quality requirements meet the standards of Grade 3 or higher as specified in GB 6142. The seeds are depilated before planting to meet the requirements of mechanical sowing. The sowing amount is 15~20 kg/hm<sup>2</sup>, and the sowing depth is 2~3 cm. It was forbidden to graze in the reseeding year. From the second year, grazing is prohibited from the end of April to the beginning of June when the pastures return to green.

This project adopts reseed fill no-till seeding machine to seed, its working process is: break shovel will loose soil and cutting off the grassroots, using the pipe to put the fertilizers into the soil, crusher break the soil into pieces, and make the soil and fertilizer mixing, using the pipe sent seeds into the soil, repressor will mild compact the surface soil, the whole seeding operation is complete. In the process of mechanical no-tillage reseeding, soil surface crushing, sowing, fertilization and soil re-coverage compaction are completed at same time, and the impact on grassland is minimized. The compaction process not only avoids the loss of grass seed but also soil erosion caused by loose soil surface. The impact on the environment is relatively small, but the re-seeding of grass will impact and damage to the original soil structure and grassland vegetation, which will lead to the change of ecological structure within the re-seeding range.

### **1.1.3 Manual planting grass**

The project uses livestock sleeping circle for the manual planting grass, its present situation is the growth weed, and the grass quantity production capacity is low. To choose tall Qingyin no.1, no. 2, Qinghai 444, precocious oat and *Vicia sativa* for manual planting grass, established stable, high-yield manual planting grassland.

In this project, no-till is adopted for seeding. The seeding rate is 100 kg/hm<sup>2</sup>, and the sowing depth is 3-4 cm. The seeding method is a drilling tillage. Sowing time is in mid-May. After the broadcast, repression is carried out to ensure that the sputum and the emergence are neat. In the autumn, castration is used to prepare hay and storage for high-quality forage for livestock feeding.

The manual planting grass project is a small project, although it will cause a certain degree of trauma to the native land, but because of the no-till method, seeds are sown and covered immediately after ditching, and the environmental impact disappears with the growth of herbage. In the planting season, the native grassland ecosystem will be disturbed to some extent.

## **1.2 Preventive measures during construction time**

### **1.2.1 Dust pollution control**

The closer to the construction site, the greater the concentration of dust in the air will be. Since the project is fence-reinforced, the amount of work is very scattered and the length involved is long. However, the amount of work in each construction area is small. In addition to being on vast grassland and has little impact on the environment. If the local area involves dismantling or a large amount of work, sprinkler measures can be taken at the construction site to reduce the dust concentration at the construction site. Minimize the impact of dust generated during construction on the surrounding environment. If it is removed, it is recommended to remove the removed materials as soon as possible to avoid stacking affecting the environment. Considering that construction, material transportation and loading and unloading are all phased operations. With the end of the construction, the impact of dust on the surrounding atmospheric environment will also end.

Manual planting grass and grassland reseeding: dust will be generated in ditching. After ditching, seeding and soil covering will be completed together, with a small amount of production, and it is located in wide grassland, and its impact on the environment is acceptable. It is suggested that the manual planting grass should be carried out in sections, and the furrows, seeds and soil covering should be completed at the same time to minimize the impact. And reseeding should be carried out separately to avoid one-time planting in large area. With the end of planting, the impact of dust on the surrounding atmosphere also ends.

### **1.2.2 Water pollution control**

The domestic sewage in this project mainly comes from the construction workers, and most of them belong to local residents. If the construction area is far away from the residential area, its catering and fecal sewage should be abandoned away from the water source. Avoid contaminating nearby water bodies. The domestic sewage of this project is limited to the construction period and the relative time is short. After the above water treatment measures, the influence of construction domestic sewage on the surrounding water environment can be effectively prevented.

### **1.2.3 Noise pollution control**

Construction noise generally affects the acoustic environment of sensitive points such as villages within 200m along the line. Some transport vehicles will have a certain impact on the residential area near the embankment. Due to its vast grassland, it is not sensitive to environmental impacts, and only areas adjacent to the home will have an impact. It is recommended to control construction time in these areas. The project is limited to construction during the day and avoids lunch breaks (12:00~14:00). Ensure that the noise value at the noise sensitive target meets the requirements of the Acoustic Environmental

Quality Standard (GB3096-2008).

#### **1.2.4 Waste control**

The solid waste generated during the construction period is mainly the material waste and domestic garbage that may be replaced during the fence reinforcement process. Material waste and domestic garbage should be stored separately. Material waste should be cleaned up and disposed of in time, and domestic garbage should be taken back to the living area for treatment.

#### **1.2.5 Ecological impact control**

During the construction period, the grassland vegetation within the construction area may be damaged and the soil erosion will be aggravated. Therefore, during the construction period, the rainy season (May-August) should be avoided to reduce soil erosion.

During the sowing of herbage, should avoid the early dry season in spring. In the process of no-tillage reseeding, the process of sod cutting, soil loosening, reseeding and covering is adopted to reduce soil disturbance and soil erosion, and at the same time, it can better retain heat, retain moisture and resist drought, and promote the grass growth. According to the topography, the zoning of planting grass was carried out, and adopts measures according to local conditions and implements them step by step.

## **2. Impacts on the environment during operation and mitigation measures**

After the construction of fence reinforcement activities, no more pollutants will be generated.

In the technical part of the project, the grassland yield is increased by means of grassland reseeding and manual grass planting. At the same time, the livestock stocking system is implemented to reduce the carrying capacity of grassland. This will restore the pastures in the project area and increase the vegetation coverage. Combine the biological management of rats and insects to reduce the amount of pesticides used. The restoration of pastures will also reduce the occurrence of rodents. The implementation of the project can promote the benign development and restoration of grassland and promote the sustainable development of grassland ecosystem. With the restoration of grassland, it can also reduce soil erosion, conserve water and protect wetlands, and contribute to the protection of the source water of the Yangtze and Yellow Rivers. Therefore, the environmental impact during the operation period is a good aspect.

### **2.1 Manual planting grass**

The environmental impact of manual planting grass mainly includes tillage and manual

grassland cultivation. The manual grass sowing will affect a small range of biodiversity.

The main measures include: In manual grassland cultivation, use organic fertilizers produced from local livestock as much as possible, and avoid the impact of chemical fertilizers on soil structure and properties.

The selected land is mainly the livestock sleeping circle, and the grass seed is selected as the local dominant herbage as the manual planting grass species. As long as the management is strengthened, the project implementation will not have a great impact on the environment of the project area, which is acceptable.

## **2.2 Pest control and prevention technology**

For pest control in the project area, 1.2% nicotine and matrine (U Hazard Class) are used as insecticides to spray in the harmful area; the appropriate time for control is from mid-june to mid-july. After spraying, grazing is banned for 15 days.

As an insecticide, 1.2% nicotine is a plant derived pesticide. The main active ingredients are matrine and nicotine, which belong to pyridine derivative alkaloids and have the characteristics of high efficiency, low toxicity, low residue, no pollution and safe use. After 7 days, the residue in different objects and soil is lower than the national standard, so there is no residual problem. Low dosage, which is easy to get degradation in the environment, in nature it also can be rapidly decomposed, the final products are carbon dioxide and water, and it has no pollution to the environment. At the same time, this agent is rich in nitrogen, phosphorus, potassium and a large number of trace elements, which have fertilizer effect on crops. Control pests with preserving biodiversity in the project area.

There are two kinds of rodent control measures in the project area: Firstly, the plateau zokors are controlled by shooting with bows and arrows, which will not affect the environment and is required to protect the working staff, the project is organized and implemented by the construction party that wins the bid and employs the migrant workers who have experience in catching rats. Pikas in the plateau are controlled by baiting from the mouth of the cave. In order to ensure the safety of livestock, grazing is strictly forbidden in the control area, and grazing must be banned for more than one week in the baited area.

The pesticide used in rats was D-type Clostridium botulinum toxin (U Hazard Class), which was ingested by the mouth and absorbed by the intestine and then acted on the junction of cranial and cerebral nerves, peripheral nerves and muscles, as well as plant nerve endings, resulting in muscle paralysis and motor nerve endings paralysis, and it was extremely toxic, and the rats died within 3~7 days after being swallowed. As a new biological rodenticide agent, it not only has good control effect on plateau pikas, but also does not harm the natural enemies of rats, the dead rats were pecked by eagles and Tibetan foxes and no poisoning was

observed. It is strong toxicity, low dosage, no secondary poisoning, no pollution of the environment, even safety to human and animal. In the management of grassland rodent, this new biological rodent control technology can continuously control grassland rodent, protect grassland ecological environment and maintain grassland biodiversity.

### 2.3 Efficient breeding technology of Tibetan sheep and yak

The environmental impacts of Tibetan sheep and yak breeding mainly include odor, excrement and urine, and animal and poultry epidemic prevention.

In this project, Tibetan sheep and yak breeding were kept in the enclosure during the period of grazing ban, the enclosure feeding in the local area was open, with good air circulation, which was naturally discharged into the air. Because it is herdsman scattered breeding, the environmental impact is very small. There is no large number of residents in the surrounding areas, only farmers and herdsmen live nearby, which will not affect the residents.

Moeller town belongs to the northwest region of China. The livestock and poultry excrement coefficient is converted to the manual of livestock and poultry industry source production and sewage coefficient issued by China in 2009 as an important basis. In addition to other relevant literature, the livestock and poultry sewage coefficient and nutrient average content in this region are shown in Table 1.

Table 1 sewage coefficient and nutrient average content of livestock and poultry excrement

| Animal species | Fecal resources (kg/d) | TN (g/d) | TP (g/d) |
|----------------|------------------------|----------|----------|
| Beef cattle    | 20.42                  | 104.1    | 10.17    |
| Sheep          | 0.87                   | 2.15     | 0.46     |

Table 1 shows the sewage coefficient and nutrient average content of livestock and poultry manure. According to the number of various livestock and poultry in Moeller town in 2018 (365 days per year), the production volume of livestock and poultry manure in Moeller town in 2018 and the nutrient content contained in these feces are shown in Table 2.

Table 2 livestock and poultry manure production and nutrient content in Moeller in 2018

| Animal species | Fecal resources (t/a) | TN (t/a) | TP (t/a) |
|----------------|-----------------------|----------|----------|
| Yak            | 714518.06             | 3642.57  | 355.86   |
| Tibetan sheep  | 99571.93              | 246.07   | 52.65    |

According to the situation in the project area, cow and sheep manure can be treated and applied as resources, fertilizer utilization. The manure is collected and stacked in the yard of herdsmen for air drying. In winter, it can be used as heating material according to the habit of herdsmen, the rest can be compost as organic fertilizer, apply organic fertilizer to manual planting grass in spring every year as fertilizer, instead of chemical fertilizer, reduce the impact of chemical fertilizer on the environment, at the same time to cultivate soil; extra organic manure can be applied to pasture.

According to the calculation, the annual amount of livestock and poultry excrement

produced by Mohler town in 2018 is 814,000 tons, equivalent to 3888.6 tons of nitrogen and 408.5 tons of phosphorus. Moeller town covers 5.7402 million mu, equivalent to 382,700  $\text{hm}^2$ . Some studies have shown that the amount of nitrogen applied to large-scale fertilizer should be controlled at 150-180  $\text{kg}/\text{hm}^2$ , beyond which the environmental pollution will be caused. It was calculated that if all the manure was returned to the field as fertilizer, the nitrogen application amount could reach 10.16  $\text{kg}/\text{hm}^2$ , far below the threshold value. Some studies have shown that the application amount of phosphorus in soil manure should not exceed 80  $\text{kg}/\text{hm}^2$ , according to calculation, if all the manure is returned to the field as fertilizer, the application amount of phosphorus can reach 1.67  $\text{kg}/\text{hm}^2$ , much lower than the threshold value.

So, the land in Moeller town is strong enough to apply the manure.

## Annex 1 Summary of the Project Environmental Supervision and Management

| No                         | Management item                   | Mitigation Measure   | Implementation agency   | Supervision agency   |
|----------------------------|-----------------------------------|--|---|--|
| <b>During design</b>       |                                   |  |   |  |
|                            | Environmental protection measures | <ol style="list-style-type: none"> <li>1. During the construction period, the grassland in the construction area may be trampled and destroyed. If the restoration measures are not taken in time, will cause the soil erosion· so the rainy season will be avoided during the construction to reduce the soil erosion·</li> <li>2. The temporary stacking of materials should be cleaned as soon as possible after the construction to avoid the impact on the ecological environment.</li> <li>3. The manual planting grass activities should avoid the rainy season.</li> <li>4. The no-tillage reseeded is carried out by no-tillage machine, which the ditching, sowing, covering and suppression of soil at same time to reduce the influence on natural grassland.</li> </ol> | Design institutes<br>Assessment institutes  |  |
| <b>During construction</b> |                                   |  |   |  |
| 1                          | Air Pollution                     | Dust   | <p>The closer to the construction site, the greater the concentration of dust in the air will be. Since the project is fence-reinforced, the amount of work is very scattered and the length involved is long. However, the amount of work in each construction area is small. In addition to being on vast grassland and has little impact on the environment. If the local area involves dismantling or a large amount of work, sprinkler measures can be taken at the construction site to reduce the dust concentration at the construction site. Minimize the impact of dust generated during construction on the surrounding environment. If it is removed, it is recommended to remove the removed materials as soon as possible to avoid stacking affecting the environment. Considering that construction, material transportation and loading and unloading are all phased operations. With the end of the construction, the impact of dust on the surrounding atmospheric environment will also end.</p> | <p style="text-align: center;">Constructors,<br/>Contractors</p> <p style="text-align: right;">PMO,<br/>County/Town<br/>PMOs,<br/>County EPS,<br/>Environmental<br/>experts,<br/>ESs</p> |

| No | Management item         | Mitigation Measure   | Implementation agency     | Supervision agency  |
|----|-------------------------|--|---------------------------|---|
|    | Tail Gases              | <p>1.Mechanical equipments and vehicles in good operation status should be selected for project construction;</p> <p>2.Fuel-powered equipments and vehicles must be operated under normal condition to ensure their emission comply with discharging standards.</p> <p>3.Rational use of equipments with strengthened maintenance and repairment of equipments.</p>  | Constructors, Contractors | PMO, County/Town PMOs, County EPS, Environmental experts, ESs |
| 2  | Construction Noise      | <p>Construction noise generally affects the acoustic environment of sensitive points such as villages within 200m along the line. Some transport vehicles will have a certain impact on the residential area near the embankment. Due to its vast grassland, it is not sensitive to environmental impacts, and only areas adjacent to the home will have an impact. It is recommended to control construction time in these areas. The project is limited to construction during the day and avoids lunch breaks (12:00~14:00). Ensure that the noise value at the noise sensitive target meets the requirements of the Acoustic Environmental Quality Standard (GB3096-2008).</p> | Constructors, Contractors | PMO, County/Town PMOs, County EPS, Environmental experts, ESs |
| 3  | Surface Water Pollution | <p>The domestic sewage in this project mainly comes from the construction workers, and most of them belong to local residents. If the construction area is far away from the residential area, its catering and fecal sewage should be abandoned away from the water source. Avoid contaminating nearby water bodies. The domestic sewage of this project is limited to the construction period and the relative time is short. After the above water treatment measures, the influence of construction domestic sewage on the surrounding water environment can be effectively prevented.</p>   | Constructors, Contractors | PMO, County/Town PMOs, County EPS, Environmental experts, ESs |
| 4  | Solid Wastes            | <p>The solid waste generated during the construction period is mainly the material waste and domestic garbage that may be replaced during the fence reinforcement process. Material waste and domestic garbage should be stored separately. Material waste should be cleaned up and disposed of in time, and domestic garbage should be taken back to the living area for treatment.</p>   | Constructors, Contractors | PMO, County/Town PMOs, County EPS, Environmental experts, ESs |
| 5  | Ecological Conservation | <p>During the construction period, the grassland vegetation within the construction area may be damaged and the soil erosion will be aggravated. Therefore, during the construction period, the rainy season (May-August) should be avoided to reduce soil erosion. During the sowing of herbage, should avoid the early dry season in spring. In the process of no-tillage reseeding, the process of sod cutting, soil loosening, reseeding and covering is adopted to reduce soil disturbance and soil erosion, and at the same time, it can better retain</p>   | Constructors, Contractors | PMO, County/Town PMOs, County EPS, Environmental experts, ESs |

| No | Management item                | Mitigation Measure  | Implementation agency        | Supervision agency  |
|----|--------------------------------|---|------------------------------|---|
|    |                                | heat, retain moisture and resist drought, and promote the grass growth. According to the topography, the zoning of planting grass was carried out, and adopts measures according to local conditions and implement them step by step.   |                              |   |
| 6  | Construction safety and Health | <p>1. Contractors should ensure the provision of up to the mustard first aids. Tools for first aids should be provided.</p> <p>2. Training on occupational health and safety to the new construction workers should be provided to introduce to them the basic working rules, personnel protection rules, and ways to prevent themselves or others from being hurts;</p> <p>3. Contractors should furnish their workers with personnel protective equipment.;</p> <p>4. The construction site should be equipped with sunstroke supplies, reasonable arrangements for rest time, when high-temperature operation;</p> <p>5. Procedures and systems for recording and reporting occupational accident, diseases, risks should be established by contractors.</p> | Constructors,<br>Contractors | PMO,<br>County/Town PMOs,<br>County EPS,<br>Environmental experts,<br>ESs |
| 7  | Others                         | <p>1. Safety supervisor(s) should be desinated at construction sites;</p> <p>2. If cultural relics are chance found, construction activiites should be suspended immediately. The case should be reported to local cultrual relics authorities. No construction activities can be rexumed until the completion of appriasial and protection actions taken by cultural relics authority;</p> <p>3. Physical examination on construction workers should be carries out periodically to provent incidence of epidemic diseases</p>   | Constructors,<br>Contractors | PMO,<br>County/Town PMOs,<br>County EPS,<br>Environmental experts,<br>ESs |

## Annex 2 Site Inspection Checklists

Sub-project Name :

Site Location:

Name of Construction Site:

Weather:

Inspected by:

Inspection Date:

| No | Environmental Issue   | Yes | No | N/A | Remark/Proposed actions |
|----|---|-----|----|-----|-------------------------|
| 1  | Are there any natural habitats or physical cultural resources that are very sensitive to local residents in the project area? |     |    |     |                         |
| 2  | Are there important vegetation, trees within the project area range?  |     |    |     |                         |
| 3  | Whether the project occupies nature conservation area?  |     |    |     |                         |
| 4  | Whether the Project construction sites have a significant impact on the local residents?                                      |     |    |     |                         |
| 5  | Whether there will be floods during the rainy season?   |     |    |     |                         |
| 6  | Are there any known archeological, historical, cultural heritage? (e.g. tumulus, mausoleum)                                   |     |    |     |                         |
| 7  | Are there any endangered species in the project area?   |     |    |     |                         |
| 8  | Are there any traffic conflict between construction shortcut (to be borrowed from municipal road) and local traffic?          |     |    |     |                         |
| 9  | Whether No-tillage seeding machine Is Normal?   |     |    |     |                         |
| 10 | Others  |     |    |     |                         |

### Annex 3 Checklist for supervision environmental protection during construction time

Climate Smart Management of Grassland Ecosystems Project No

Date

Instruction to filling the table: this is formalized table for Climate Smart Management of Grassland Ecosystems Project to carry out the environmental protection during construction time supervision. It is focused on the local environmental conditions and project content, and environmental mitigation measures. Adding of information or adjustment can be made when needed.

Name of subcomponent: Contract No and Project Site:

Name of construction site:

Current phase of construction:

Date of environmental supervision: Detailed timing:

Daily weather conditions:

Inspector:

| Inspection Items  | Implemented? |     | N/A | remark (i.e. problem observed, possible cause of nonconformity and/or proposed corrective/preventative actions |
|---|--------------|-----|-----|--|
|   | yes          | No* |     |  |
| <b>1. Air pollution control</b>   |              |     |     |  |
| 1.1 Whether to adopt measures such as spraying water to reduce dust in the dust-flying area of construction site?   |              |     |     |  |
| 1.2 Whether the dismantled materials are cleaned and transported as soon as possible?   |              |     |     |  |
| 1.3. Are the materials on the construction site centralized stacked, and sheltered?   |              |     |     |  |
| 1.4. Are No-tillage seeding machines normal?  |              |     |     |  |
| 1.5 Others  |              |     |     |  |
| <b>2. Water Pollution Control</b>   |              |     |     |  |
| 2.1 Whether the construction worker's domestic waste is thrown at will? It is strictly forbidden to put into the water body along the line, it must be collected and treatment.             |              |     |     |  |
| 2.2 Whether to strengthen the environmental protection education for the constructors and their environmental consciousness? The constructors should not throw waste or sewage in disorder. |              |     |     |  |
| 2.3Others   |              |     |     |  |
| <b>3. Noise Control</b>   |              |     |     |  |
| 3.1 Are the low-noise main machinery and equipment used for?  |              |     |     |  |
| 3.2 Are silenced equipments utilized?   |              |     |     |  |
| 3.3 Control the construction time strictly?   |              |     |     |  |
| 3.4 Are all mechanical equipment maintained and maintained regularly and effectively?   |              |     |     |  |
| 3.5Others   |              |     |     |  |
| <b>4. Waste Management</b>  |              |     |     |  |
| 4.1 Whether construction waste are classified and stored in accordance with the relevant provisions of waste classification   |              |     |     |  |

| Inspection Items  | Implemented? |     | N/A | remark (i.e. problem observed, possible cause of nonconformity and/or proposed corrective/preventative actions |
|---|--------------|-----|-----|--|
|   | yes          | No* |     |  |
| management, and promptly cleared, transported as soon as possible?  |              |     |     |  |
| 4.2 Are temporary facilities removed in time when the project is finished?  |              |     |     |  |
| 4.3 Others  |              |     |     |  |
| <b>5. Ecological Conservation Management</b>  |              |     |     |  |
| 5.1 Is rationale optimization of the construction site layout to reduce the scope of construction activities and reduce the extents of site vegetation destruction?   |              |     |     |  |
| 5.2 Is contractor keeps its construction duration as shorter as possible, to minimize the scope of construction disturbance at the pre-conditions of construction quality ensurance.                          |              |     |     |  |
| 5.3 Whether making related education to construction workers to avoid the stampede of arable land, destruction of crops and other cash crops in the construction process, resulting in cuts and other losses? |              |     |     |  |
| 5.4 Others  |              |     |     |  |
| <b>6. Emergency Preparedness and Response</b>   |              |     |     |  |
| 6.1 Whether the contractors ensure the provision of up to the mustard first aids. Tools for first aids should be provided?  |              |     |     |  |
| 6.2 Is training on occupational health and safety to the new construction workers?  |              |     |     |  |
| 6.3 Whether the contractors furnish their workers with personnel protective equipment   |              |     |     |  |
| 6.4 Whether the construction site is equipped with sunstroke supplies, reasonable arrangements for rest time, when high-temperature operation   |              |     |     |  |
| 6.5 Is reporting, recording system established by contractor for occupational accidents, incidence of daises and accidents?   |              |     |     |  |
| 6.6 Others  |              |     |     |  |
| <b>7. Cultural Heritage</b>   |              |     |     |  |
| 7.1 Are certain or uncertain cultural relics found during construction?   |              |     |     |  |
| 7.2 If found cultural relics, ensure appropriate measures taken to preserve it?   |              |     |     |  |

*\*Any "No" recorded represents the potential breach of regulation or improvement needed. ES should immediately issue "A notice sheet for correction actions to be taken by contractors" and such issuance code number in the Remarks, the details of corrective actions taken by contractor should be recorded separately.*

Signature of Site Inspector

Date

Reviewed by Environmental Supervisor

Date

**Annex 4 Environmental Supervisor's Notice Sheet for Correction Actions to be taken by Contractors**

Name of Subproject Contract Name and location

Construction Site

Status of Construction

Main issues inspected: :

Contractor's analysis on the root course of the issue and proposed correction measure:

Comments from Local EBP (if necessary)

Issued by (name of ES) date  
 deadline for correction:  
 accepted by(name of contractor) date

Conclusion of re-inspection:

Re-inspected by date

## Annex 5 Checklist for post approval and Acceptance of Environmental Measures

Climate Smart Management of Grassland Ecosystems Project

No

Date

Instruction to filling the table: this is formalized table for Climate Smart Management of Grassland Ecosystems Project to carry out the supervision of the post approval and Acceptance of Environmental Measures. It is focused on the local environmental conditions and project content, and environmental mitigation measures. Adding of information or adjustment can be made when needed.

Name of subcomponent:

Contract No and Project Site:

Name of construction site:

Current phase of construction:

Date of environmental supervision:

Detailed timing:

Daily weather conditions:

Inspector:

| Inspection Items  | Implemented Situation |    | N/A | Remark (i.e. problems observed, possible cause of nonconformity and/or proposed corrective/preventative actions) |
|---|-----------------------|----|-----|--|
|   | Yes                   | No |     |  |
| 1. Whether all the waste in the construction site is cleared, transported and disposed? |                       |    |     |  |
| 2. Whether the Waste treatment after construction?                                      |                       |    |     |  |
| 3. Whether No-tillage seeding machine is Normal?  |                       |    |     |  |
| 4. Whether the re-seeding and manual planting grass to complete coverage at same time?  |                       |    |     |  |
| 5. Whether training and education programs are carried out among project areas?         |                       |    |     |  |
| 6 How satisfied is the public in local resident with the construction project?          |                       |    |     |  |

*Any "No" recorded represents the potential breach of regulation or improvement needed. ES should immediately issue "A notice sheet for correction actions to be taken by contractors" and such issuance code number in the **Remarks**, the details of corrective actions taken by contractor should be recorded separately.*

Signature of Site Inspector

Date

Reviewed by Environmental Supervisor

Date

## Chapter 10 Conclusion

The project aims to promote the construction of grassland ecological protection and the sustainable development of grassland husbandry by establishing a climate-smart grassland ecosystem management model, and provide a successful model for the construction of “village revitalization” and “landscape forestry and lake grass” life community in China. The project belongs to the key areas of the fifth operational plan of GEF, in line with the “building an eco-friendly society”, “protecting the ecological environment with the system” and “village revitalization strategy” proposed by the Party Central Committee. The project meets the actual needs of grassland ecological protectors and producers to increase production and increase efficiency.

Through activities such as integration and demonstration of high-efficiency animal husbandry production technology for climate-smart grassland, and innovation and application of supporting policies and grassland ecological reward policy, and management capacity building at all levels and improvement of community knowledge capabilities, it can create a grassland production system that is highly efficient in reducing emissions and grassland carbonation, and break through the technical and policy bottlenecks in the existing grassland ecological protection and construction, and enhance the adaptability of agriculture and animal husbandry systems to climate change, and achieve grassland carbonation, and improve the living standards of farmers and herdsman, and coordinate economic development with ecological protection, and achieve remarkable comprehensive benefits of ecology, economy and society.

This project is consistent with the 13th Five-Year Plan of Qilian County in the project area, and the implementation of the relevant contents of this project is helpful to the realization of the planning objectives. The site selection of the Merle Town project area is out of the protected area.

The project may involve some environmental impacts: Ecological fence, No-till seeding, artificial planting of grass, pest control.

The environmental impact and mitigation measures for the Project as follows.

### **The construction time:**

- (1) Dust pollution control

Fence reinforcement: the closer it is to the construction site, the higher the dust concentration in the air will be. Since the project belongs to fence reinforcement, the amount of work is very scattered and the length involved is long, but the amount of work in each construction area is very small. In addition to being on vast grasslands, it has little impact on the environment. If the local area involves demolition or a large amount of work, sprinkling measures can be taken on the construction site to reduce the dust concentration of the construction site, so that the dust generated during the construction period will have a minimum impact on the surrounding environment. If there is demolition, it is suggested to remove the dismantled materials as soon as possible to avoid the impact of stacking on the environment. Considering that engineering construction, material transportation and loading&unloading are staged operations, the impact of dust on the surrounding atmospheric environment will end with the end of construction.

Manual planting grass and grassland reseeding: dust will be generated in ditching. After ditching, seeding and soil covering will be completed together, with a small amount of production, and it is located in wide grassland, and its impact on the environment is acceptable. It is suggested that the manual planting grass should be carried out in sections, and the furrows, seeds and soil covering should be completed at the same time to minimize the impact. And reseeding should be carried out separately to avoid one-time planting in large area. With the end of planting, the impact of dust on the surrounding atmosphere also ends.

#### (2) Water pollution control

The domestic sewage in this project mainly comes from the construction personnel, and most of them belong to local residents. If the construction area is far from the residential area, the catering and waste water should be far from the water source to avoid polluting the nearby water body. The domestic sewage in this project is limited to the construction period, which is relatively short. Through the above measures, the impact of domestic sewage on the surrounding water environment can be effectively prevented.

#### (3) Noise pollution control

Construction noise will generally affect sensitive acoustic environment for villages within 200 m along the route, and some transport vehicles and no-tillage machines will have a certain impact on residential areas near the embankment. Because it is located on the vast grassland, it is not sensitive to the environmental

impact, and only the area adjacent to the residence will have the impact. In these areas, it is suggested to control the construction time, limit the construction in the daytime, avoid lunch break time (12:00~14:00), and ensure that the noise value at the noise sensitive target meets the requirements of the standard limit in acoustic environment quality standard (GB 3096-2008).

#### (4) Waste control

The solid wastes generated during the construction period are mainly material wastes and domestic wastes that may be removed and replaced during the reinforcement of the fence. Materials garbage, household garbage should be classified storage, material garbage should be cleaned and removed for disposal in time, and household garbage should be brought back to the living area every day for treatment.

#### (5) Ecological impact control

Within the range of planting grass and reseeding, the grassland vegetation may be damaged, leading to the aggravation of soil and water loss. The planting period should avoid the rainy season (from May to August) to reduce the soil and water loss.

During the sowing of herbage, avoid the early dry season in spring. In the process of no-tillage reseeding, the process of sod cutting, soil loosening, reseeding and covering is adopted to reduce soil disturbance and soil erosion, and at the same time, it can better retain heat, retain moisture and resist drought, and promote the benign growth of grass seeds. According to the characteristics of topography, the zoning of planting grass was carried out, and adopts measures according to local conditions and implements them step by step.

#### **The operation time:**

##### (1) Artificial planting of grass

The environmental impact of manual planting grass mainly includes furrow cutting and cultivation of manual planting grassland. The cultivation of herbage by artificial seeding can affect the biodiversity on a small scale.

The selected land is mainly the livestock sleeping circle, and the grass seed is selected as the local dominant herbage as the manual planting grass species, hay is mowed in autumn. As long as the management is strengthened, the project implementation will not have a great impact on the environment of the project area, which is acceptable.

The grass species are cultivated and domesticated into local fine forage species, and their cultivation will not cause the invasion of alien species.

In order to avoid the inconsistency of the quality of grass seeds, or the introduction of weed seeds by unscrupulous merchants, the project purchases high-quality forage seeds through open tendering to control the quality of grass seeds to meet the requirements of Grade 3 and above specified in GB 6142; The planting area of the project will issue seeds and we will guide the key technical links such as the establishment, management, harvesting and utilization of manual planting grassland to ensure the supply of high-quality forage materials for the livestock feed of the project.

If it is found that wild oats are mixed, the wild oat seeds in the seeds can be removed by rotation with the row crops, or the wild oats can be germinated by shallow tillage before planting in the oats, then the ground is eliminated, and then planted. The method can also be controlled by chemical depurinating agents.

#### (2) Pest control and prevention technology

To use as far as possible for the physical control such as artificial killing. Under the No-till seeding、Spring-forbidden grazing, the increase of grassland coverage, are disadvantageous to the survival of rodent, and finally using low toxic biological pesticides to minimize the impact on the environment.

#### (3) Efficient breeding technology of Tibetan sheep and yak

In this project, the nutritional structure and feed composition of the original livestock and the source of the pasture are not changed to prevent the risk of invasion by foreign organisms.

In this project, Tibetan sheep and yak breeding were kept in the enclosure during the period of grazing ban, the enclosure feeding in the local area was open, with good air circulation, which was naturally discharged into the air. Because it is herdsman scattered breeding, the environmental impact is very small. There are no large number of residents in the surrounding areas, only farmers and herdsmen live nearby, which will not affect the residents.

Estimated cow and sheep manure can be treated and applied as resources, and fertilizer utilization. The manure is collected and stacked in the yard of herdsmen for air drying. In winter, it can be used as heating material according to the habit of herdsmen, the rest can be compost as organic fertilizer, apply organic fertilizer to manual planting grass in spring every year as fertilizer, instead of chemical fertilizer, reduce the impact of chemical fertilizer on the environment, at the same time to cultivate soil; extra organic manure can be applied to pasture.

It was calculated that if all the manure was returned to the field as fertilizer, the nitrogen application amount could reach 10.16 kg/hm<sup>2</sup>, the application amount of phosphorus can reach 1.67 kg/hm<sup>2</sup>, is below the threshold value. So, the land in Moeller town is strong enough to absorb the manure.

Veterinary stations are especially responsible for epidemic prevention in the project area, the responsibility system for epidemic prevention and control is implemented, both administrative and professional work responsibilities are taken at the same time, administrative for density control, professional work for quality. Every township in Moeller Town has animal husbandry and veterinary station, which has fixed funds. Animal husbandry and veterinary station collects and hires vehicles to carry out for harmless treatment when the animals died of diseases are reported to the herdsman. The treatment mode is deep burial, and the location is chosen to be far away from the water source to avoid contamination of surface water and groundwater.

#### (4) Invasive alien species

In order to avoid the inconsistency of grass seeds quality, or the introduction of weed seeds by unscrupulous merchants, the project purchases high-quality forage seeds through open tendering to control seeds quality to meet the requirements of Grade 3 and above specified in GB 6142. The planting area of the project will supply seeds and will be guided the key steps of technology such as: the plant, management, harvesting and utilization of manual grassland to ensure the supply of high-quality forage materials for the livestock feed of the project.

Grass species control: The project need to select grassland no-tillage reseeding agricultural companys with a certain scale of qualification, and organize the implementation of no-tillage reseeding based on the village-level government in the project area. At present, no-tillage seeding and manual planting grass have been carried out for many years in the project area. There is no invasion of alien species, So there is almost no harm to alien invasion in the project area.

Supervision for the foreign feed (forage) purchase: After many years of the foreign feed (forage) purchase in this region, no damage has been found in the project area, so the risk of alien invasion is very small for the foreign feed (forage) purchase may happen in the project area. In this project, the nutritional structure and feed composition of the original livestock and the source of the pasture are not changed to avoid the risk of alien invasion.

If found that wild oats are mixed, the wild oat seeds in the seeds can be picked

and throw away by Crop rotation, or the wild oats can be germinated by shallow tillage before planting in the oats, then kill the whole grass by chemical herbicides, and then planted.

#### (5) Biodiversity

In Qilian Mountain National Park Reserv, there are many kinds of wild animals, including more than 20 species such as wild yaks, wild donkeys, white-lipped deers, snow leopards and bears.

As shown in the 4.1 project location, the project area is not within the protected area, and the project activities will not affect wildlife. During the investigation, the herdsmen reported that there were some wild animals in the mountain protection area. When the food is shortage, the wild animals would occasionally go down to herdsmen's pasture to forage. Most of them are wolves, which caused losses to the herdsmen's livestock in the project area. All herdsmen know that wildlife should be protected, and the forest public security and insurance compensate for the casualties of wildlife in pastoral areas when herdsmen's livestock are killed or injured by wild animals.

The negative impact of the project on the environment can be minimized through mitigation measures. Therefore, the project implementing responsibilities are required to implement the project in strict accordance with the requirements of environmental assessment, and strictly implement the environmental management and monitoring plan, entrust the local authorities to monitor, keep the file and reports on time, and submit to the World Bank regularly.