

# Environmental Challenge and Agricultural Practice in Qinghai Liupan Mountain Area

Research Report



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## **List of Acronyms**

<b>CPMOs</b>	County Project Management Offices
<b>IFAD</b>	International Fund for Agricultural Development
<b>VIGs</b>	Village Implementing Groups
<b>BPA</b>	Bureau of Poverty Alleviation
<b>BWR</b>	Bureau of Water Resources
<b>BAL</b>	Bureau of Agriculture and Livestock
<b>FD</b>	Forestry Department

## **Introduction**

After economic reform in 1979, China has developed rapidly and has become one of the biggest world economies. Yet the development was clustered in the eastern regions, widening the regional disparities and leaving the western regions with poverty. Therefore, since 2000, the government has started implementing policies to develop poor western regions, including Qinghai, by drawing both internal and external investment into the regions and focusing on the infrastructure development and capacity building. Qinghai Liupan Mountain Poverty Alleviation Area is one of the prioritised areas outlined in the China Poverty Reduction Outline 2011-2020. The area is characterised by (a) dependency on agriculture and livestock production; (b) the presence of a significant percentage of disadvantaged but economically capable people; and (c) degraded land resources (IFAD, 2015).

### ***IFAD Qinghai Liupan Mountain Area Poverty Alleviation Project***

The Chinese government has prioritised agriculture to increase farmers' income, to reduce poverty and to ensure food security of the county. Along with the national policy, the government and IFAD support people in the rural area with financial and material resources, such as infrastructure, equipment, plants, animals, as well as knowledge to improve their livelihood. Activities of skill improvement were endorsed to villagers so that they can increase their income and improve their livelihood. The project consists of four components: 1) climate-resilient infrastructure (i.e. irrigation infrastructure enhancement); 2) market-oriented agriculture (i.e. cash crop with reconstructing/constructing greenhouses, economic tree crops, livestock development, and market access); 3) Off-farm livelihood support (i.e. various skills such as embroidery, cooking, business management, etc.); and 4) Project management and coordination. This IFAD project is a cooperation of several departments, including Department and Bureau of Agriculture and Livestock, Department and Bureau of Environmental Protection, Department and Bureau of Agriculture and Livestock, Bureau of Poverty Alleviation, Department and Bureau of Water Resources, Department of Finance, Forestry Department, Disabled Persons' Federation and Women Federation.

### ***Qinghai and Poverty***

IFAD (2015) illustrates several reasons that cause poverty, for instance, high altitude, closed location, poor transportation and infrastructures, inadequate public services, low education level, disasters, and constraints to generate income. For Qinghai, the constraints that impede income generation and production involve limited water resources, low resilience to natural calamities, low productivity and value-addition, lack of market access and capital inputs, and degraded land resources (IFAD, 2015). Because of these factors, farmers could generate relatively small amount of productions and thus do not have a strong bargaining power. They need to be linked with farmer cooperatives but the currently formed cooperatives in the area are at the developing stage. Farmers cooperatives need support to increase self-development capacity, governance, branding and marketing, while farmers should also be trained to become self-reliant and self-sufficient.

## **Literature Review**

### ***Qinghai and Environmental Challenges***

According to IFAD (2015), the major environmental challenges in the project area are drought, water scarcity, and soil erosion. Drought usually happens during spring and summer, which is the time during cultivation. Even though some irrigation systems existed, most of them are obsolete and inefficient. Currently there are only 27% arable land equipped with irrigation facilities and its average water use efficiency is 30-40% (IFAD, 2015). This implies that the large fragment of arable land in Qinghai is rain-dependent, which can be susceptible to unpredictable weather. The other problem is soil erosion and landslides in the

loess plateau. Soil erosion occurred due to unequally rainfall distribution which concentrates between June and September, together with traditional slope farming. Erosion can lead to losses of soil nutrition and biodiversity, land degradation, heavy suspended sediment loads in water body and the damage of irrigation system (IFAD, 2015).

Climate change is another key issue that complexes and intensifies the above-mentioned environmental issues, which create higher pressure in the agricultural sector. IFAD (2015) mentioned that the temperature in the northern Qinghai Tibetan Plateau has been increasing and has become higher than the global amplitude. The temperatures in the 1980s was 20% warmer than those in the 1960s. The amplitude of this area was predicted to reach 3°C by 2050. The change in climate has degraded tundra ecosystem and caused soil and air temperature to increase (Wang et al., 2010). The permafrost degradation also affects the ground water level and cause lakes and swamp to become drier (Cheng and Wu, 2007). Yet the higher temperature has also created a great number of lakes (Xinhua, 2017). As Qinghai has a continental arid and semi-arid monsoon climate, the higher temperature can cause the soil to become drier. Liu Liyuan reported that “the annual precipitation has decreased by 13.99 millimetres every 10 years” (Xinhua, 2010). Climate change can cause Qinghai weather to become more unpredictable and agricultural sector can be more vulnerable.

## **Research Questions**

Because the environmental challenges, such as climate change, are one of the factors that obstruct the development and lead to poverty. Understanding the context of the environmental problem is essential to find appropriate solutions to mitigate those impact and increase resilience preparedness for the unpredictable events. This research project seeks to explore the environmental and climate challenges faced by the local agriculture sector and the government agencies, agricultural practices that have been applied in the project area, the government’s and local communities’ perspectives of environmental issues, and policies to mitigate the environmental challenges and to support agriculture. There are three main questions in this research.

1. What are the key environmental problems in the Qinghai Liupan Mountain Area?
2. What are the ways/policies to mitigate these challenges?
3. How sustainable and resilient are the current agricultural practices and how to make it more sustainable and more resilient?

## **Study area**

This project was conducted in western China, Qinghai District. The area is called Qinghai Liupan Mountain Area covering seven counties in two prefectures: Huangzhong, Huangyuan, Minhe, Ledu, Huzhu, Hualong and Xunhua, shown in figure 1. These counties are located between the Qinghai-Tibetan Plateau and the Loess Plateau in China (IFAD, 2015). The general landforms are gorges and mountains on highland. The altitude of the project area ranges from 1650-4635 meters above the sea level. The climate is in the temperate zone with arid and semi-arid monsoon. The annual rainfall is approximately 300-530 mm, which usually concentrates during June to September. The annual temperature is 7.3 °C and the temperature is highest in July and August. The agriculture in the area has a relatively short growing season during the frost-free period, roughly 100-160 days which depend on altitude.

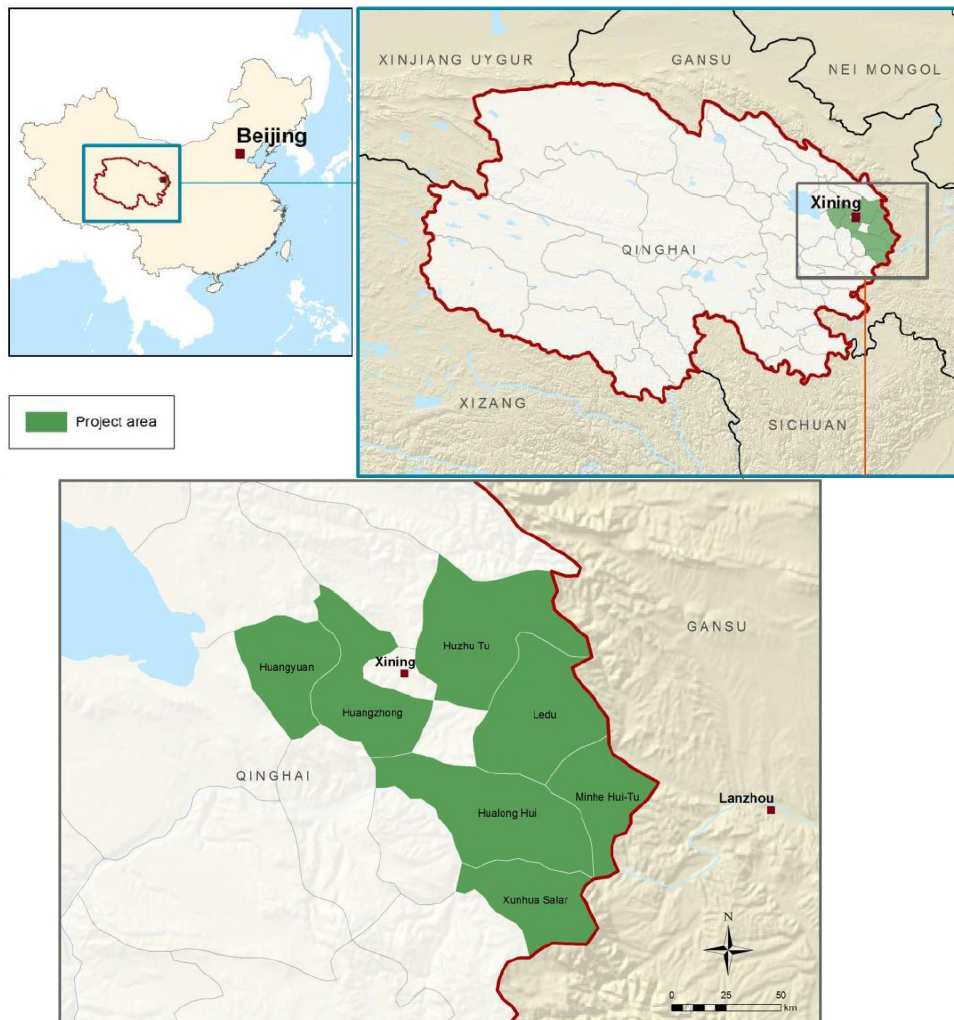


Figure 1. The map shows the area of Qinghai Liupan Mountain Area Poverty Alleviation Project. The project includes seven counties: Huangyuan, Huangzhong, Huzhu, Ledu, Hualong, Minhe and Xunhua.

### **Other sections...**

This research report has 5 sections. Section 1 is the introduction detailing above, describing about the importance of this research project and the IFAD Qinghai Liupan Mountain Area Poverty Alleviation Project. Section 2 details the methodology and research methods that were used in the field. Section 3 includes the results which summarise from the data collected in the field. Section 4 is the discussion regarding the results conducted in the field and includes some suggestions that might be brought into the field for adjustment. Section 5 is a conclusion for the overall findings.

## **Methodology and research methods**

The research was conducted over a period of ten weeks from May to July 2018. Methods applied consist of the following: key informant interviews, a focus group discussion and literature review.

Two semi-structured interviews with two provincial government agencies: Agriculture and Livestock Department and Forestry Department, and one focus group discussion with the County Project Management Offices (CPMOs) were conducted in order to learn about the environmental problems occurring in the area, policies that have been implemented to mitigate those problems and the agricultural practices that farmers have applied in the areas. The interviewees from Provincial Agriculture and Livestock Department is the director of Planning Office and the other one from Provincial Forestry Department is the deputy director of the project office. The County Project Management Office participated in the focus group discussion includes working staff from different departments, including Bureau of Poverty Alleviation (BPA), Bureau of Water Resources (BWR), Bureau of Agriculture and Livestock (BAL), and Forestry Bureau (FD). These departments are most familiar with farmers and have been working with IFAD to drive this project. Questions used to ask these two groups are outlined in Appendices.

Twenty-five semi-structured interviews with local people were conducted to understand the perceptions about climate change of the local communities, crops they grow and their agricultural practices. The sampling method was conducted casually with help from IFAD to gather some villagers to these interviews during the visit of the evaluation team in the first and second weeks of July. Sixteen of the interviews were conducted in Ledu District, five were conducted in Minhe County, two were conducted in Huangyuan County and one was conducted in Hualong County. The number of farmers in each county were based on time available in the area. Questions used to ask farmers are outlined in Appendices.

During the placement, IFAD invited monitoring and the evaluation teams to visit the villages, which is an opportunity to gain some background of those areas. Casual interviews with the village implementing groups (VIGs) and villagers are also conducted during the visits of monitoring process in each county. Simple questions were asked to learn about the environment of the area, the geography of the location, and plants that are commonly grown.

The research also includes some insights from literature review in the relevant subjects which aims to understand the context and the problems of the area, the policies that have been implemented and to find any improvement that can be made in the project area.



## **Results**

### ***Climate (Change) Impact***

#### ***Finding from the government sector***

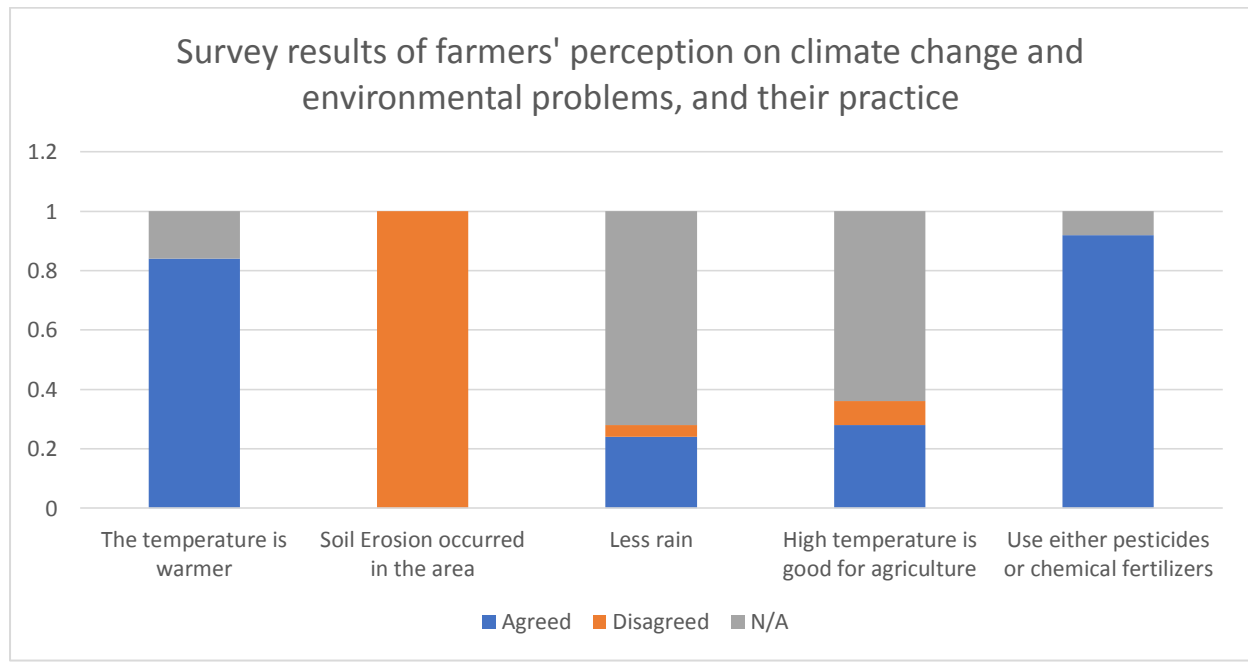
Qinghai has been facing drought and has limited amount of water for consumption and agriculture. The temperature difference between day and night is large. Their growing season is relatively short. All previous mentioned issues have impeded the agricultural productivity. Consequently, most vegetables in the province are imported from different parts of the country, such as Hainan Province (Y Li 2018, personal communication, 16 May).

During the interview on 16<sup>th</sup> May 2018, Li Yande, the deputy direct of Project Office in Forestry Department, stated that since 1981, this year (2018) has been the hottest year in Qinghai. In addition, spring has come 10-15 days earlier than it was in the past, while winter has come later. The water area of Qinghai Lake has been expanding, glacier has been melting, wetland has become degraded and changed to grassland. Deputy Li explained that the climate change issue has arisen since 1981, when the temperature rose up to 35 °C. However, he believed that there is not much impact on agriculture. He also described about the history of the area that during the 1950s and the 1960s, Qinghai was deforested, which destroyed the environment massively. Thus, in 1998, the Forestry Department has carried out the conservation project. In 2000, they implemented the policy of returning farmland to forest. They said “Qinghai is not a province with economic benefits yet ecological benefits.”

The project officers in Huzhu County recognized that the environmental problems in the area include drought, lower precipitation than previous years and lakes have become drier. The soil in the area has been very dry. Yet 2018 has more rain than usual. The environment of this county is decent; water has good quality. There is not much pollution and no erosion has evidenced. Yet the staff in the irrigation office said that there is relatively little vegetation in the area because there are few varieties of flowers suitable for the climate in Qinghai.

During the casual interview with Professor Liu Yonggong on 4 July 2018, from Chinese Agricultural University, he told that in the past, the area had evidenced high precipitation during winter which brought a heavy snow storm and killed cattle. Several pieces of evidence regarding the climate challenges might lead to the conclusion that Qinghai weather might become more unpredictable and fragile.

## ***Findings from farmers***



The Project Office in Huzhu County has mentioned that farmers have no concept of climate change. Yet, they seem to recognize a change. According to the interviews, twenty-one out of twenty-five villagers said that they felt that the temperature was warmer than the past. Only a few did not think that the temperature had changed. One farmer mentioned that he thought winter and spring were slightly colder than the past, yet he thought the current temperature had been higher than ten years before. Farmers did not recognise any environmental problems, including soil erosion, in the area. On the other hand, they stated, “the environment has become better” because “the area is greener as there are more trees” today. They also explained that both air and water were cleaner than before. Six farmers mentioned that “there was less rain than the past”. Only one farmer stated that there was “more and more rain”. Seven farmers stated that they thought that the higher temperature was beneficial for cultivation. They could grow plants earlier and more variety kinds of plants. Four farmers complained that the higher temperature would make them “felt more uncomfortable” and lazier. In addition, two farmers argued that the “warmer climate can make animals sick”. One farmer said that he noticed that there are more insects today. Regarding agricultural practices, most farmers revealed that they either use chemical fertilizers or pesticides in their crops. Farmers also use natural fertilizer which comes from animal defecation.

## ***Agriculture***

### ***Soil***

Qinghai Liupan Mountain Area locates between the Qinghai-Tibetan Plateau and the Loess Plateau. Most soil in the project area is classified as Loess (B Zheng 2018, personal interview, 6 July), which is a type of silt forming topsoil layer and has yellowish or brown in colour. The figure 2 shows the components of Loess and where it lies among other soil types. Loess contains small amount of clay particles, allowing the soil to hold it together, and quartz crystals, causing particles to collide each other which can be susceptible to erosion (Edu.pe.ca, 2018). Since loess is abundant with minerals, well-aerated, easily penetrated by plant roots and easy for cultivation, it is appropriate for agriculture (Catt, 2001; National Geographic Society, 2018). However, the disadvantage of this soil is its low water holding

capacity (B Zheng 2018, personal communication, 6 July), which limits plants that can be grown in this type of soil.

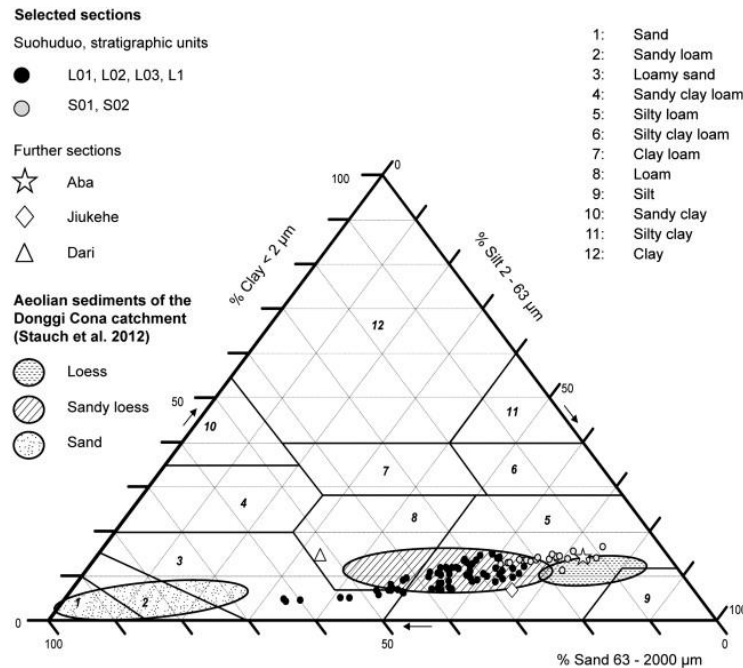


Figure 2. Different soil types contain different percentages of clay, silt and sand. This figure emphasizes loess, sandy loess and sand. (Lehmkuhl et al., 2014).

The project officers in each county has indicated different types of soil and agricultural production in their areas shown in the table below\*.

County	Elevation	Soil type	Crops and specialties**
Huangyuan	2,800 meters above sea level	Loess	Raspberry, rapeseed, broad bean ( <i>Vicia faba</i> )/fava bean/horsebean, peas, potato, wheat, rye, oat, highland barley/Qingke barley
Huangzhong	2,600 meters above sea level	Loess	Water Spinach, wheat, broad bean ( <i>Vicia faba</i> )/fava bean/horsebean, potato, chili, tomato, mushroom, eggplant, scallion, strawberry
Huzhu	2,600-3,000 meters above sea level	loam	Raspberry, rapeseed, broad bean ( <i>Vicia faba</i> )/fava bean/horsebean, wheat, potato, highland barley, peas, Astragalus membranaceus/mongholicus and Angelica (medicinal plants) Huzhu Eight-eyebrow pigs**
Ledu	2,230 meters above sea level	Black soil	Rapeseed, potato, garlic, wheat, cherry, Chinese rhubarb ( <i>Rheum officinale</i> ), Ledu Chili**
Hualong	2,600-2,800 meters above sea	laterite	Potato, rapeseed, Walnut, barley, legumes, wheat

	level		
Minhe	1,650-2,500 meters above sea level	Clay, laterite	Walnut, wheat, rapeseed, legumes, potato
Xunhua	1,800-2,000 meters above sea level	Loess, laterite	Rapeseed, potato, chili, eggplant, tomato, walnut, apple, pear, apricot, grape, peache, watermelon**, bottle gourd** (Allium scorodoprasum)

\*Information gathered from interviews and IFAD project design report

### **Plants**

During the interview, Deputy Li explained that the native plant in Eastern part of Qinghai is seabuckthorn, that in yellow river area is large fruit cherry, that in Xunhua and Minhe Counties is walnut, and that in Huangyuan and Huzhu counties is raspberries. When asking about the local species in the area, Li said “tree species that are best adapt in Qinghai are Poplar tree, Willow, Corolla and Qinghai Spruce”. During the interview with the project officer in Huzhu County on 17 May 2018, the officer also mentioned similarly that “local trees in the area include Qinghai Spruce, Seabuckthorn/Hippophae Phamnoides, Qinghai Poplar, and Tamarix or Red Salix”. On the other hand, the economic trees of the project area would be Cherry and walnut, which require roughly 3-7 years to bear fruits.

### **Practice**

In the project area, farmers have applied crop rotation. For instance, in Huzhu County, growing Angelica, the medicinal plant, can cause soil hardening and deplete soil nutrients, thus the following year, farmers would grow soybean or fava beans to return nutrients back to the soil. In addition, in Xunhua, farmers apply intercropping. They grow crops in between apple trees to earn income while waiting for these trees to grow and give produces.

Since the climate in the project area is arid and semi-arid continental climate, Huzhu County has promoted the construction of greenhouses and intelligent digital planting. This approach has help farmers increase production and income, make laboring easier and there is no harm to the environment. Local farmers in the project area use organic fertilizer, such as farm manure, to prevent soil hardening/compaction. In addition, due to drought, the project has implemented irrigation construction, machinery deep tillage and film mulching (Huzhu Project Office 2018, focus group discussion, 17 May). Though farmland and sloping fields are difficult to access farmland irrigation because the construction would be expensive and not cost-effective. In general, agricultural practices outside the greenhouse usually start when soil starts defrosting, which is from April or Qingming Festival, also known as Tomb sweeping Day, and harvest in October during the National day (Huangyuan VIG 2018, personal interview, 6 June; Huzhu Project Office 2018, focus group discussion, 17 May). Farmers start preparing in autumn by covering film mulch in autumn to prevent water loss from soil (S Mo 2018, personal interview, 17 May).

### **Farmers’ story about their practice**

Most crops, such as wheat, are subsistence crops, though the remains from their harvest are sold to the market (farmers 2018, personal communication, 4-9 July). They do not usually use pesticides on those plants that are grown for their own consumption. However, crops that are grown for sale usually have pesticides because of pest interference. Since the growing season in Qinghai is short, the project has supported recondition and construction of greenhouse. Farmers who have greenhouses can grow crops all year round, which can help them generate the income during off-growing season. However, during the visit in Huzhu County, a farmer told that she “wished that there are more variety kinds of plants available to grow.” Farmers who have greenhouses would have higher climate

resilience and are more prepared to face the unpredictable weather in the future than those with no facilities.

### **Relevant Policies and Projects**

The current government has been focusing much on the environmental problems in Qinghai Province. President Xi Jinping does not emphasize on GDP in this particular area yet focuses on environmental protection (Y Gao, personal communication, 18 May). Thus, the core of Qinghai implementation is “ecological priority strategy”, aiming to protect the ecosystem. Projects aiming to improve grassland ecology in Qinghai include as follow:

- **“Repairing grassland policy”** has implemented restoring grazing land to grassland project. This policy restricts grazing from farmers and herdsmen by indicating “grazing prohibition” area. Farmers and herdsmen are encouraged to raise less sheep, yet they are subsidized by the government. In addition, if a herdsman takes care of the grassland themselves, the national government will grant them subsidies. The policy also intends to raise environmental awareness of farmers and herdsmen through promoting grassland management (Y Gao 2018, personal interview, 18 May).
- **Sanjiangyuan Nature Reserve Zone Ecological Conservation and Development Programme** promotes conservation and construction of the protected area. This area is the most important water source for China and Asia as it is the source of three rivers: Yellow, Yangtze and Mekhong Rivers. Yet the region has been destroyed by human activities, such as overgrazing, poaching of plants and animals and mining (Wang, 2010). The government is committed to protect the whole region by returning farmland near the protected area to grass, banning grazing, and conserving wetlands, to improve water quality (Y Gao 2018, personal communication, 18 May).
- **The Qilian Mountain Water Source Conservation Areas of Ecological Environmental Protection and Integrated Management Programme** conserves and restores mountains, rivers, forest, farmland, lakes and grassland (The State Council Information Office of the People's Republic of China, 2018).

In addition to grassland ecosystem, ecological protection has another focus on fishery ecology. The government has designated protected areas to protect aquatic species, such as Qinghai Lake Yellow Fish (Y Gao 2018, personal communication, 18 May). The government attempts to manage and determine the sustainable yield of the fishery (FAO.org, 2018).

## Discussion

The government sector and local communities have recognised that the temperature of the area has increased. However, it seems to be a gap in between the two sectors, where the government has solid evidence about the ongoing environmental and climate situation. They have a big picture of the current situation and its consequence. On the other hand, farmers only recognised that there is a change in temperature in the area, but they did not know the potential consequences of the problem which they can be affected. Farmers seem to have relatively little awareness and concern of climate change, where they have thought that the increase in temperature is an advantage for agriculture. There is a need for the government's action to disseminate the knowledge about appropriate agricultural practices and the potential consequences of environmental challenges that farmers will be facing in the future with plans to deal with the issues. On the other hand, soil erosion was not mentioned as a problem for both the government and agriculture factor. The government has mentioned that they have emphasised on environmental protection and conservation to the area, while villagers also evidence these actions and see the positive impact as they mentioned that the environment is greener now.

In terms of agricultural practice, generally every county in this project can grow wheat potato, and rapeseed. The variety of plants is limited by location, climate and altitude. Assumingly, growing plants in the greenhouse can increase a potential to grow more kinds of crops, yet there were not many kinds of crops available to farmers. The project can diversify and provide different types of crops that are suitable for the climate and location. On the other hand, the agriculture outside greenhouse can apply agroforestry to improve the environment and agricultural production in the area. Agroforestry is the land-use system that manages land by assimilating crops, trees and/or animals (RESET.org, 2018). The system integrates ecology, agriculture and forestry together. During an interview conducted on 12 April 2018, Mr. Boonrung Sridum, a Thai agriculture expert, stated that agroforestry can be broad; "it can be thought as an agricultural system that imitates forest. In this system, plants will seek their ways to survive. When they are in the situation that they must fight with pest, they will start to adapt themselves in order to survive and continue their life... Chemicals are the element that make plants become weak." Using chemicals does not allow plants to learn how to fight on their own and eventually they will become weak and unable to survive by themselves. The application of agroforestry has proved to provide several benefits, including prevent soil erosion and loss of water and nutrients (RESET.org, 2018). Agroforestry might be another solution to increase the resilience and sustainability of agricultural practice in this area.

Frankly, environmental problem does not the only cause of poverty in the region, yet another problem is the social and economic elements. The project can also apply the philosophy of Sufficiency Economy developed by King Bhumibol Adulyadej of Thailand. The idea advocates the middle path that can be applied by people at all level. It consists of three principles: moderation, reasonableness and self-immunity, along with the conditions of morality and knowledge (Mongsawad, 2010). The three principles are interconnected to each other. Firstly, "Moderation" implies that people should maintain their life in the middle path without overindulgence. This can occur when they have "reasonableness"—gaining from "accumulated knowledge and experience, along with analytical capability, self-awareness, foresight, compassion and empathy" (Mongsawad, p.128). The third principle is "self-immunity", which suggests people to have ability to protect themselves from the external turbulence and the unpredictable or uncontrollable events. This concept also implies that people should have a good foundation of self-reliance and self-discipline. In addition to the three principles, two conditions, knowledge and morality, are needed to exercise the principles. "Knowledge" denotes the accumulated information, which need to be applied with prudence. "Morality" refers to "integrity, trustworthiness, ethical behaviour, honesty, perseverance, and a readiness to work hard" (Mongsawad, p.128). Morality is needed to create a good society and a liveable community. All these principles together with the two conditions are the basic of decent living which can be applied in all level. Accordingly,

farmers can apply this idea in their life to have a balanced way of living and happiness in their life.

## **Conclusion**

The key environmental problem in the Qinghai Liupan Mountain Area is climate change which can complicate other environmental problems such as soil erosion, drought and flood. These consequent issues can impede the agricultural activities of the area and cause a huge loss for farmers. The current practices that are applied by the farmers, such as crop rotation, might not be enough to resist these problems. Crop rotation might limit farmers to only one to two kind of crops. If an unpredictable event occurs and destroys one type of crops, farmers with monoculture practice can lose all their crops from that situation. Agroforestry is one idea for farmers to apply in their land management to increase resilience of their practice.

Farmers should be informed about the ongoing climate situation or the potentially occurred events as a consequence of climate change that might happen in the area. Firstly, the government should inform about climate change, its concept, consequences and ways to mitigate and prepare for the unpredictable events. In addition, the government should support and disseminate the knowledge advancement of agriculture and provide choices for farmers to manage their land. Yet they need to provide concise knowledge to help farmers make a firm decision.

The government has policies to protect the environment in the area in place, however the implementation might lack of the involvement of local people, which is a necessary component to a sustainable development and environmental protection. Thus, there is a need for integration of all stakeholders, including local people's participation.

When seeking for sustainable agriculture, three aspects, environment, social and economic, should also be integrally considered so that the development can be sustainable. Thus, there is a need for agricultural practice that is good for environment yet allows farmers to subsist themselves and allows local communities to have interaction and form unity in the society.



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## **Appendices**

### **Questions for the government sector**

#### **Role and Relationship**

1. Could you please tell me your name and role at the provincial level?
2. Could you please tell me what your role involves?
3. How long have you been in this role?
4. Whom do you report to at the national level? Who is your point of communication at the county-level and village level?

#### **Policy**

1. What are the main policies to support agriculture sector while also protect the environment in this area? What are regarded policies? What are other aspects of agricultural policies?
2. Who is in charge of implementing these policies and how do they implement them?
3. What are targets that the national agricultural policy been implemented in this area?
4. What is the national environmental policy implemented in this area that involves climate change and agriculture? Does the policy involve farmers' participation? How does the farmers get involved?
5. Regarding these policies, which departments that you have been working with?
6. How has the national environmental policy been implemented in this area?
7. What have your sector done to support the environment and the agriculture of the area?
8. How have forest and agriculture been managed?
9. Does the land currently used by farmers belong to farmers or belong to government?
10. Who make the decisions regarding the land use of this area?

#### **Climate and environmental challenges**

1. What are the main agricultural activities in the targeted area (Qinghai—Poverty Alleviation targeted areas)?
2. What impacts of climate change have farmers? What are the most significant impacts in past year, 5 years and 10 years in the area?
3. How has their agriculture been impacted by disasters, such as flood and drought?
4. What is agroforestry in farmers' perspectives?
5. Are farmers using the land for just a single crop?
6. Do they see the benefit of climate smart cropping/planting option?
7. What agricultural practices that farmers apply currently to increase climate resilience while also maintain economic income?
8. Do farmers think that this practice has helped improve their agricultural productivity? Such as increase climate resilience to disasters—i.e. floods, droughts, etc.

#### **Agricultural practice**

1. What methods have farmers applied on their farms to increase their agriculture productivity?
2. What are native plants that have been/was grown in the area? What are the benefits of these plants?
3. What plants have been used to prevent soil erosion? What soil management have been practiced?
4. What was the agricultural practice that have been practiced since the previous generations?
5. What agricultural practice does work and doesn't work?

6. Have farmers changed their cultivated goods? Have they grown different crops? How has the shift been?
7. How have you seen the productivity changed since the start of the project? What do you think would be beneficial to increase crop productivity and climate resilience?

### **Questions for farmers**

1. What do you grow?
2. Why do you grow this crop?
3. Do you use chemical fertilizer? Do you use pesticides?
4. Are they cash crop or subsistent crop?
5. What environmental problems do you recognize?
6. Are you aware of climate change?
7. Do you have the concept of climate change? What do you think it is?
8. In your opinion, how climate change will impact you?
9. Have you observed any changing patterns over the last 10 years?