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Analysis of Factors Influencing Forest Carbon Sequestration Project in Guangdong Province and Recommendations

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Abstract Through designing questionnaires for farmers in the project area, the understanding and utilization of carbon sink forests were surveyed. In the form of stratified sampling, 150 representative forest farmers were selected from the project area. Through the survey, it found that many factors hindered the progress of forest carbon sequestration project in Guangdong Province. Besides, the implementation of this project was influenced by both natural and social factors. As to the natural factors, natural disasters for the forest carbon sequestration project in Guangdong Province mainly include typhoons, rainstorms, landslides and mudslides. The social factors of the forest carbon sequestration project in Guangdong Province mainly include the weak willingness of forest farmers to participate, the low awareness of forest farmers for forest carbon sinks, the single and insufficient source of afforestation funds, and the single afforestation model. In order to better implement the forest carbon sequestration project, Guangdong Province can take measures such as strengthening the publicity on forest carbon sinks, expanding channels of funds, organizing forest carbon exchange training courses, and diversifying the afforestation models.

Key words Forest carbon sequestration project, Influencing factors, Guangdong Province, Recommendations

1 Introduction

To mitigate global climate changes and protect human living environment, the third Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) adopted the *Kyoto Protocol* in 1997, which for the first time provided legally binding for 41 industrialized countries (countries in Appendix I). The greenhouse gas emission reduction target requires the above-mentioned industrialized countries to reduce the greenhouse gas emissions by an average of 5% from 2008 to 2012, at least on the basis of 1990. In February 2005, the *Kyoto Protocol* which aimed at reducing the global greenhouse gas emissions finally came into force. With its formal entry into force, forestry carbon sink becomes an important project type under the *Kyoto Protocol*, providing a new opportunity for forestry development of China. Since 2004, the Carbon Sequestration Management Office of the State Forestry Administration has launched pilot projects for forestry carbon sequestration projects in Guangxi, Inner Mongolia, Sichuan, Hebei, Shanxi, Yunnan, and Liaoning provinces, respectively[1-2]. Guangdong Province, funded by China Green Carbon Fund in 2008, carried out carbon sequestration projects in Longchuan County and Chaoyang District in Shantou City; specifically, it afforested 200 ha of ecological public welfare forest in Dengyun Town and Longcheng Town of Longchuan County, including 148.7 ha in Dengyun Town and 51.3 ha in Tuocheng Town (148.7 ha in Dengyun Tounty and 51.3 ha in Tuocheng Town); it afforested 200 ha ecological public welfare forest in Neishe and Longxi villages (128.93 ha) in Xilu Town (71.07 ha), Chaoyang District of Shantou City.

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2 Analysis of characteristics of forest carbon sequestration project in Guangdong Province

2.1 Not belonging to project of *Kyoto Protocol* The forest carbon sequestration project of Guangdong Province was supported by the China Green Carbon Fund from China National Petroleum Corporation for 3 million yuan, separately subsidized 1.5 million yuan for Longchuan Forestry Bureau and the Chaoyang District Forestry Bureau of Shantou City, and the afforestation was undertake by Longchuan Forestry Bureau and the Chaoyang District Forestry Bureau of Shantou City separately. For domestic enterprises, this project is implemented to set up corporate images, create good public relations, reflect the compensation for greenhouse gas emissions through the carbon credit generated from this project, accordingly establish excellent relationship for enterprises. This project is not a project level cooperation between China and countries listed in Appendix I to *Kyoto Protocol*. In the process of afforestation, it did not consider the project baseline, non-persistence, leakage and additionality, so it is not a project of *Kyoto Protocol*[3-4].

2.2 Voluntary transaction activity The forest carbon sequestration project in Guangdong Province was not designed in accordance with rules of *Kyoto Protocol*. The transaction is voluntary action of enterprise. It is voluntary transaction action undertaken by Chinese enterprises to respond to climatic changes, so as to set up their images, promote regional development, and protect biodiversity.

2.3 Building the ecological public welfare forest Longchuan forest carbon sequestration project is arranged in the ecological public welfare forest in Shuangqiao Village of Dengyun Town and Dongyao Village in Tuocheng Town, a total of 200 ha of artificial afforestation area, including 148.7 ha in Dengyun Town and 51.3 ha in Tuocheng Town; Chaoyang forest carbon sequestration project of Shantou City is arranged in Neishe Village and Longxi Village in Xilu Town, including 128.93 ha in Neishe Village and 71.07 ha in Longxi Village. The operation design of the two forest carbon sequestration projects is based on the design principles of appropriate tree, centralized, favorable for construction and management of construction. At the same time of maximizing carbon sinks, and biodiversity conservation and forest promotion in the project site, the projects combined with protection of local biodiversity, promotion of sustainable development of forest resources, and maintenance of local economic and social development level, and water and soil conservation, to strive to build ecological public welfare forests.

3 Influencing factors of the forest carbon sequestration project in Guangdong Province

3.1 Natural factors Generally, natural disasters such as rainfall, lightning, extreme temperatures, fires, plant diseases and insect pests, floods, droughts, hurricanes, volcanic eruptions, earthquakes, and mudslides can damage mature forests or forests in the growing period, leading to partial or whole reversion of the stored carbon, and changing the total carbon stock of the forest[6].

For the forest carbon sequestration project of Guangdong Province, Longchuan County of is located in the mountainous area of northern Guangdong Province, the terrain is complex, the monsoon and local climate are different, and the severe weather occurs frequently. Natural disasters mainly include: low temperature and rain, flood, drought, cold dew wind, frost, strong wind, and hail, as well as insect pests, and earthquakes[7]. Chaoyang District of Shantou City is situated in the southeast coast of Guangdong Province, close to the Tropic of Cancer, and belongs to the subtropical marine climate. Natural disasters mainly include typhoons, heavy rains, landslides and mudslides. The occurrence of many natural disasters has affected the growth of trees, leading to carbon reversal, which is not favorable for the implementation of forest carbon sequestration projects.

3.2 Social factors

3.2.1 Single afforestation mode. The forest land in the two project areas is owned by the village collective and is managed by the collective. The forestry bureau of the project area signs an agreement with the local village committee to carry out afforestation on the village land. The economic benefits obtained after the tree felling belong to the village collective. The village collective keeps some and the rest is allocated to forest farmers. Such afforestation mode cannot stimulate the enthusiasm of the forest farmers. In the survey, many farmers in the project area stated that if planting trees on their own land, they would do, but if planting trees on the collective land, they will be reluctant and hesitate.

3.2.2 Weak willingness of forest farmers to participate. For the forest carbon sequestration project in Guangdong Province, we surveyed a total of 95 forest farmers in Shuangqiao Village in Dengyun Town, Dongyao Village in Tuocheng Town, Neishe Village and Longxi Village in Xilu Town. The survey items are as follows: Are you willing to pay a fee for the construction and protection of carbon sinks 26.67% forest farmers answered Yes, 63.33% answered No, 8.33% did not answer, and 1.67% answered not clear. The largest ratio among the four survey results was unwilling, accounting for 63.33% because most forest farmers believe that afforestation is a government matter, and some forest farmers believe that their income is low and their capabilities are limited. The specific survey results are illustrated in Fig. 1.

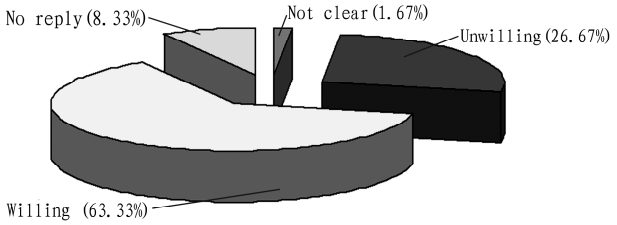

Fig. 1 Willingness of forest farmers to participate

3.2.3 Low awareness of forest farmers for forest carbon sinks. According to the sample survey of a total of 95 forest farmers in the forest carbon sequestration project area in Guangdong Province, 11.58% forest farmers stated that they are very familiar with the project, 7.37% forest farmers said that they have a certain understanding of the project, 60.00% and 21.05% forest farmers were completely not known or just knew little. The specific results were shown in Fig. 2. The reasons why forest farmers do not understand the forest carbon sequestration project are mainly as follows. (i) Forest farmers have low educational level. (ii) Forest farmers care about the immediate benefits of the forest carbon sequestration project, but do not realize the long-term benefits of the project. (iii) The publicity of forest carbon sinks is not fully implemented.

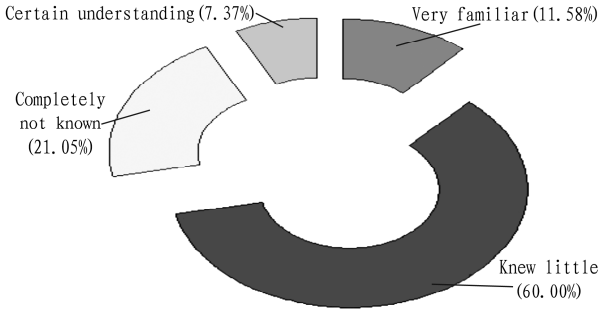

Fig. 2 Understanding of forest farmers about the forest carbon sinks

In the survey on the awareness of forest carbon sequestration projects, among the 95 respondents, most of the forest farmers in the project area did not know the composition of the forest species of the forest carbon sequestration project, accounting for 89.47%. Only a few forest farmers knew the project, accounting for

10.53%, and they knew the project mainly through the media and network, or just saw the project when they climb the mountain.

3.2.4 Single and insufficient afforestation funding source. In the forest carbon sequestration project in Guangdong Province, the lack of publicity and low awareness of the forest carbon sinks, except China National Petroleum Corporation, no other enterprises invest in the forest carbon sequestration project. As a result, the fund for the forest carbon sequestration project in Guangdong Province is single and mainly provided by China Green Carbon Fund from China National Petroleum Corporation.

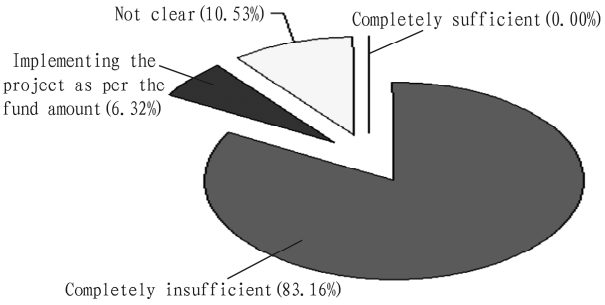

Fig. 3 Afforestation fund amount of forest carbon sequestration project

In the survey of fund amount for the forest carbon sequestration project in Guangdong Province, 83.16% forest farmers thought that the fund amount is completely sufficient, 6.32% forest farmers said that they would implement the project as per the fund amount, 10.53% forest farmers said they were not clear, and no forest farmers believed that the fund amount is sufficient. The specific results are shown in Fig. 3.

3.2.5 Certain hidden trouble in the protection of forest resources. In 2009, the per capita GDP of Longchuan was 10 991 yuan, and the per capita GDP of Chaoyang District of Shantou City was 10 102 yuan. In the rural areas implementing the forest carbon sequestration project, the per capita GDP was lower. Farmers use timber for cooking and heating. In the survey of project area, 55.79% of the forest farmers said that they occasionally used the carbon sink forests for fuelwood, 11.56% forest farmers said that they often used the carbon sink forests for fuelwood, and 32.63% forest farmers said that they would never use the carbon sink forests for fuelwood. The specific survey results are shown in Fig. 4. The behavior of local farmers stealing carbon sink forests will, to a certain extent, cause damage to forest resources and cause loss of forest carbon sinks, which will be unfavorable for the implementation of forest carbon sequestration project in Guangdong Province.

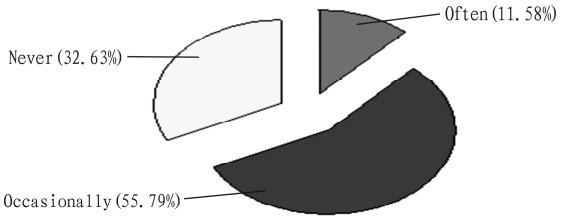

Fig. 4 Use of carbon sink forests as fuelwood

4 Recommendations

4.1 Strengthening the publicity on forest carbon sinks in Guangdong Province Forest carbon sink is a new thing. Many people do not know that the carbon sink is, and 82.05% respondents said they do not know the forest carbon sink. In order to implement the forest carbon sequestration project in Guangdong Province, it is necessary to propagate in the rural areas of the project area through the network, newspapers, magazines and schools. It is recommended to introduce the benefits brought by the implementation of the forest carbon sequestration project. Besides, it is recommended to propagate the approaches and calculation of CO_2 emissions, current climate situation, and the importance of environmental protection to the individuals.

4.2 Expanding the channels of funds Afforestation is not just a matter of the government, but also a matter of companies and individuals. Through investing in afforestation, enterprises can obtain economic benefits from cutting and selling trees, raise their image and popularity and reputation in the society, and make preparation for future carbon emission reduction. For individuals, investing afforestation and purchasing forest carbon sinks, it is able to offset their emission of CO_2 and accordingly reduce the pressure of carbon emission.

4.3 Holding the forest carbon sequestration training course In the first place, the forestry department or colleges and universities in Guangdong Province can hold the forest carbon sequestration training courses. The training courses should focus on calculation, leakage, baseline, and additionality of the forest carbon sinks. In the second place, the forest bureau should provide training for personnel responsible for afforestation in accordance with the training content, to reduce the leakage of carbon in the process of afforestation. Besides, the forest bureau should provide training for forest keepers, mainly including how to deal with forest fire, plant diseases and insect pests, and excessive and random lumbering.

4.4 Diversifying the cultivation modes The afforestation of forest carbon sequestration project area in Guangdong Province is mainly undertaken by the local forestry bureau and the village collective of the project area through signing the agreement, and the land is provided by the collective. The forestry bureau is responsible for afforestation, and the forests newly built belong to the village collective. This kind of afforestation mode is difficult to stimulate the enthusiasm of the forest farmers. On the basis of the forest tenure reform, afforestation can be implemented on the land contracted by the forest farmers, the forests will be owned by the forest farmers after the forests are built, and the cuttings are not allowed within 20 years. It is also feasible to consider short rotation period, five years, for instance. In the rotation period, cutting is allowed, to realize direct economic benefits of the forest carbon sequestration project in Guangdong Province. In this way, it is convenient for stimulating the enthusiasm of forest farmers to protect trees.

5 Conclusions

Although China has no obligation to reduce the carbon emission in

the first commitment period of 2008 – 2012, China is the country with the greenhouse gas emission only second to the United States of America, so China faces greater and greater pressure. In the face of the current climate situation, the Chinese government first announced the clear target of greenhouse gas emission reduction at the Copenhagen Climate Change Summit in December 2009. The target is reduction of greenhouse gas emission by 40% – 50% by 2020 compared with 2005. Through actively developing the forest carbon sequestration project, Guangdong Province can raise the forestry development funds. More importantly, the forest carbon sequestration project can provide a new and cheaper approach for China participating in the international community to respond to climate changes.

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