

Introduction to China Vetiver and Agroforestry Technology Project

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Abstract: China Vetiver and Agroforestry Technology Project was launched in the Dabie Mountains to increase food production, relief poverty and protect natural resources. Vetiver System and Agroforestry were introduced and demonstrated, 8,416,000 economic trees were planted, 5 pumping stations constructed in 2 villages of bordering counties of 2 provinces. Series training courses were organized and 944 persons were directly trained. The experiences and information were most widely distributed through in-direct training, information dissemination, visiting, and national and international networking. Because the project combined vetiver system extension with economic tree production and food production, it was warmly welcomed by local governments and farmers.

Key words: Vetiver, agroforestry, soil erosion

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1 INTRODUCTION

1.1 Soil Erosion and Natural Disasters

Soil erosion has been a problem ever since man started to cultivate land. It became more critical with increasing population. In the recent decades, forests decreased dramatically in China and soil erosion became more serious. Statistics of relevant data showed that in the past decade, soil fertility has declined on over 2 million hectares, and crop yield decreased by 30% due to soil degradation. The area under soil erosion has expanded to 1.5 million square kilometers in the country.

Caused by soil erosion, the level of river bed raised dramatically. For example, the bed of main reaches of the Yangtze River raises 1 meter in every 10 years. As a result, during the flooding season the water level became much higher than that of the surrounding land surface. For the lakes such as Dongtinghu Lake, the water level during flooding season was also higher than the land surface, usually 10 m higher, which threatened people's life seriously and led to disastrous consequences.

In 1998, based on the statistics by the authority, the heavy flooding caused 4150 deaths and direct economic loss of 255,090 million Yuan RMB (about US\$31,108 million). There were 6.85 million houses were destroyed. And 18.393 million people had to immigrate to safety places.

1.2 The Dabie Mountains

The Dabie Mountain 90-1700 m above sea level with a total area near 100,000 km² lies at the boundary area of three provinces, i.e. Anhui, Hubei, and Henan. Caused by various factors, the Dabie Mountain area remains under developed and forms one of the poorest region of the country with mean annual income around 800 Yuan RMB per capita (about US\$100). There are more than a dozen of counties identified as Poverty Counties by the central government.

Caused by increasing populations and multiple reasons, the original forests were almost completely destroyed. In the recent years following national economy reform, farmers and government officers have increasing interests in clearing forests for commercial tree (economic forests) production, and called it as 'forestry revolution'. They cleared vegetation, built earth

terraces and planted tea, mulberry tree, and chestnut, etc. on a large scale. Because this kind of cultivation lacked protection measures, it usually led to more soil erosion, resulting in the decline of soil fertility. Consequently, the commercial trees do not grow well. And more often, the soil was usually eroded off before commercial trees and new vegetation grew up. Meanwhile, the soil erosion aggravates sediments deposition in the reservoirs and the lower parts of the river basin and caused disastrous consequences. In August 1975, for example, flooding destroyed the dams of Banqiao Reservoir and Shimantan Reservoir, the two largest reservoirs. The bed of the reservoirs and rivers has risen by sediments and are as high as the dams in 40 places in Jingzai County. The resultant deteriorated environment aggravated poverty.

1.3 Vetiver and Agroforestry Technology

To control water and soil erosion, increase farming benefit and relieve natural disasters, soil and land use (including agroforestry systems) were investigated since 1995. This covered over 10 counties or cities in the Dabie Mountains. The Vetiver system was introduced to the Dabie Mountains in 1998.

Field trials in Yuexi County of Anhui Province, and Huanggang Prefecture of Hubei Province showed that:

- Vetiver grass could grow well in the proposed project area. The newly planted vetiver can grow 3 m high after one growing season (5-6 months) on the terrace.
- Vetiver successfully protected the newly built terraces from erosion in 3-5 months post planting in Hubei Province.
- The output of well-protected vetiver based agroforestry orchards on the terrace i.e. the vetiver-chestnut-wheat system, can reach more than 80,000 Yuan (USD10,000)/ha/yr at 8th year after planting, while the control forest is only 102 Yuan (USD12.4)/ha/yr.

The launched project was to apply the vetiver system, agroforestry and other technologies to the Dabie Mountain area, the southern part of the mountain in particular, in order to protect commercial trees, reduce the risk of natural disasters caused by poor ecology and to increase farmers' income and alleviate poverty in the area. At the same time food production is also important.

2 BACKGROUND OF THE PROJECT SITES

2.1 Brief Information on Location of the Project

Yuexi and Yingshan are the two counties of the stressed poor counties, first designated by the state, belonging to Anhui and Hubei province respectively. Both are located in hinterland of the Dabie Mountains. Two villages, Zhangfan of Changpu Township of Yuexi County and Zhengfang of Shitouzui Township of Yingshan County, were selected as key project sites. The both villages are the typical examples of the whole mountain area in natural and social-economic conditions. The topography of the both counties is dominated by medium-high mountains, with only scattered river valley basins in the mountains.

2.2 Analysis of the Causes of Poverty

2.2.1 Little arable land and low production level

In both villages, the average per capita cultivated land is around 0.4-0.5 Mu (1 Mu = 1/15 ha). The soil layer is shallow and the fertility is low caused by erosion. In particular, the water conservancy facilities are few (only 2 pumping stations irrigating 85 Mu land), so the villagers have to rely on rain-fed agriculture. On average, each Mu of land can only produce 370 kg of grain. The

grain produced by local farmers in a year cannot meet their needs. Serious food shortage plus lack of funds have resulted in an extremely low input into the land.

2.2.2 Low productivity of forestry

Although in both villages the average per capita area of mountain is 5-8 Mu, the forests have suffered from severe destruction in the recent 60 years. Today, there are merely scattered masson pines, bamboo, groves and weeds, most of which can only be used as fuel. Statistical data over the past years show that the output value of forestry for both villages only occupied 5-18% of the total value of agricultural output, the average income from every Mu of mountain was only 7-43 Yuan RMB and that the average per capita income from forests was 37-370 Yuan RMB/year. Failure to make full use of the extensive mountain lands is another important cause of the poverty.

2.2.3 Fragile ecozone

Most soils of the Dabie Mountain area are derived from granite and subject to water erosion. Following increasing population, farmers have to cultivate new sloping land for food, fuel and cash, which destroy existing vegetation cover and aggravate soil and water erosion due to a lack of soil conservation measures.

2.2.4 Poor education and health-care facilities

With traffic difficulty and few contacts with outer world, a considerable amount of villagers are illiterate or semi-illiterate. They commonly adhere to past practice and show indifference towards scientific farming, natural resource protection and commodity production. This makes it quite difficult for some advanced agricultural techniques to be introduced and popularized.

2.2.5 Lack of scientific planning

For years, local authorities and farmers cleared large area of forests for planting timber trees (Chinese Fir, for example) or commercial trees. Because this kind of development lacks scientific planning and market analysis, it consequently failed and caused new ecological problems.

3 THE GOAL OF CHINA VETIVER AND AGROFORESTRY TECHNOLOGY PROJECT

Supported by Voluntary Agencies Support Scheme (VASS) of New Zealand, New Zealand Salvation Army, AusAid, Australia Salvation Army, and Hong Kong and Macao Salvation Army and also local government and farmers, the China Vetiver and Agroforestry Technology Project (CVAT Project) was launched in 2001 with total budget of over one and half million Yuan RMB (1USD=8.3 Yuan). The objectives of the launched project was to help farmers get rid of poverty at the same time to protect natural resources from damage by:

- Introducing and raising awareness of soil and natural resources protection and the importance of vetiver in soil erosion control and sustainable agriculture, earth work stabilization, disaster prevention, sustainable farming and other numerous multiple uses among policy makers, farmers, extension workers and technicians in the Dabie Mountains.
- Introducing and extending proper agroforestry technology, such as hedgerow intercropping of vetiver-chestnut-wheat system; nitrogen-fixing trees, shrubs, and plants; contour planting technology, crop diversity for erosion control, etc.
- Generating income by establishing vetiver-protected high quality commercial trees and vegetables on terrace, raising silkworm, and small animal husbandry, mushroom cultivation, hand crafts production, etc.
- Increasing food production by developing electrical pumping systems, intercropping of commercial trees with crops, reasonable application of fertilizer based on soil and crop sample analysis.

- Helping women improve social and economic condition by training and demonstration on silkworm raising, tea production, hand crafts production with vetiver pruning, etc.
- Extending the above technologies and experiences to the whole Dabie Mountain area through multiple activities.

4 REMEDIAL MEASURES TAKEN IN THE PROJECT

Through on-the-spot investigations and studies, wide-ranging discussions with national vetiver and agroforestry network experts and technicians, visiting different types of farm households, learning from good typical examples in the surrounding areas, discussion with farmers at their home and in the field, we have implemented the following measures which have high productivity, sustainability, and adaptability:

4.1 Income Generation

Mountain land is the main resource in the two villages. Commercial trees (economic forests) with regional priority and good quality products of mulberry, chestnut and tea were planted on different kinds of land and silkworm were raised, which can dramatically generate profit. Altogether 16,000 chestnut, 400,000 mulberry and 8,000,000 tea trees were planted. All commercial trees were planted and managed with standard regulations in order that the trees grow well, produce high profit, and would not cause new soil erosion problems. Training courses were implemented on different topics such as tree management, the production of mushrooms and handicrafts with vetiver pruning.

4.2 Vetiver and Agroforestry Technology for High Quality Commercial Tree Production and Food Increase

The slope land with newly planted commercial trees may cause serious soil erosion in ecological fragile areas derived from granite without necessary protection measures. Vetiver technology was introduced and contour-planted on terrace and slope farmland for erosion control. About 5 million vetiver tillers were planted. Vetiver nurseries were established based on small farm holders. Vetiver plant tops were used as fodder for small animals and as mulch for soil moisture maintenance. Proper agroforestry technologies were introduced, demonstrated, and extended including: A-Frame contour planting of crops and trees, living hedges of vetiver and multipurpose nitrogen-fixing shrubs for soil erosion control and soil reclamation and intercropping crops in newly developed commercial trees, etc.

4.3 Increasing Food Production and Food Self-sufficiency

In Zhangban and Zhengfang, high-yielding fields only constitute 15% of the total farmland. It was planned that 5 electric pumping stations be built which will irrigate 590 Mu of rice fields and increase paddy yield by 59,000 kg.

Wheat was intercropped in newly developed chestnut terraces in order to provide more grain for farmers and increase ground vegetation cover to reduce erosion.

Vetiver pruning was used as fodder and mulch to improve soil moisture and fertility in order to guarantee food production.

Rational fertilization was used based on different soils from granite and gneiss and the analysis of soil and plant samples, which can increase yield by 10%. Organic manure was increased by husbandry development which also increased yield and benefit to sustainable agriculture.

4.4 Extension and Training

Observations and discussions revealed that there was high enthusiasm among farmers who saw extension and training as an important income generating opportunity. Because the implementation area of the proposed project was limited, while the Dabie Mountain is a large area, extension and training would be a critical measure to spread the experiences obtained from the project and was a key component of the project, especially when the original extension system met problem during the economy reform.

4.4.1 Contents of Extension and Training

Discussion with farmers at both project sites and non-project sites. The extension and training contents included:

- Soil and water conservation and reconstruction of eroded slopes and terraces,
- Vetiver: its characteristics, growth behavior, applications, reproduction, technology, and benefit,
- Agroforestry technology and crop diversity for income generation, erosion control and food security,
- Nitrogen-fixing trees, shrubs, and plants for soil fertility maintenance and sustainable farming,
- Contour-planting techniques,
- Commercial tree production and management (chestnut, tea, and mulberry trees),
- Hand crafts production of vetiver pruning.

In addition, some other contents were included in the training, for example, woman's health care, environmental protection, etc.

4.4.2 Methods of Extension and Training

- **Formal Training:** Training causes were carried out at two-stages, i.e. township level for middle school graduates and villager-group level for less educated farmers respectively. The former were the trainers for the latter. All of the training were combined with practical exercises and field demonstrations when appropriate.
- **Self-study:** supplemented by supervision and multiple training materials. Self-study of printed materials was a very cost-effective training method. Small supervision groups were organized to spread technologies and to answer farmers' questions.
- **Farmer-to-farmer Visit:** One of the challenges in this project was to create opportunities for participants at the field level to learn from each other. The 'Model' farmers were selected and awarded. Farmers were organized to visit their demonstration sites and discussions were held in-situ.

4.4.3 Extension and training materials

Printed Materials: Special training materials were prepared based on local natural conditions. Some training materials from famous development institutions at home and abroad were refereed. These materials included: the re-published *Green Book* in Chinese, the brochure on *chestnut cultivation, tea tree cultivation, and mulberry tree cultivation*, that described not only the cultivation of these economic trees but also the application of vetiver system for economic tree promotion. The printed extension and training materials all had adequate illustrations, diagrams and pictures to communicate field practices and were sent to farmers in both inside and outside project sites within the whole Dabie Mountain area. **Posters:** As a large number of poor farmers in the proposed project area has relatively low levels of education, the printed posters with numerous photos and vivid drawings prepared by TVN and Taiwan University, were sent to farmers to put on their family walls to strengthen their memory.

Newsletters and Fact Sheets: were produced to introduce practical technologies and the progress of the project. They were distributed to the whole Dabie Mountain region and surrounding

areas, including the local governments at county and township level, various bureaus and extension stations involved in agriculture, forestry, soil and fertilizer, livestock and environment, etc.

National and International Impact: the progress and experiences of the project were also distributed through out whole country and the world through national and international Vetiver Newsletters and home pages and Asia and Pacific Agroforestry Network News (APANews).

4.4.4 *Personnel of training and extension*

Trainers consisted of experts, qualified technicians and master farmers depending on the content. The experts were responsible in preparing training materials, while local technicians mainly gave lectures to farmers under the guidance of the experts, which relieved the problem caused by local language. The trainers formed a supervision team to give guidance in the field. Visiting experts were invited to present some technical lectures.

Trainees came from farmers of both project counties and non-project counties. Local governmental officials were included. Altogether over 944 people received direct training, most of whom were women and tens of thousands were in-direct trainees.

4.4.5 *Farmers' participation*

During the whole project time and even at the preparation stage, farmer participation was very important because farmers were beneficiaries and also workers. The items of farmer participation included:

- design and preparation of the project,
- comments, suggestions, and decision-making on land tenure and contract methods and conditions,
- design, selections, and improvement of crop systems and its components,
- evaluation of trees, shrubs, grasses, and food crops,
- tests and/or experiments of selected new technologies,
- improvement for the project during different stages,
- contents of training courses,
- policies which can promote the project development and benefit both farmers livelihood and the environment.

4.4.6 *Wide extension of vetiver technology*

In comparison with the whole Dabie Mountains, which includes dozens of counties and cities, the project sites were very small. To extend vetiver and related technologies, China Vetiver Network distributed huge amount of printed materials, totaling tens of thousand copies of Vetiver Newsletters, Fact sheet, Posters, the Green Book. In addition when farmers heard of vetiver information from the project sites, they positively requested printed materials and/or vetiver planting materials from the China Vetiver Network or their neighbors. The neighboring counties, townships and villages contacted China Vetiver Network and requested to launch similar projects in their area. The local newspapers of the two counties also introduced the project progress and extended vetiver technology.

In addition, the training materials were posted to agriculture stations and water conservation stations in south China outside the Dabie Mountains to introduce project experience and basic vetiver knowledge through national network.

5 CONCLUSION

Since the project was based on many years of investigation, scientific trials and on the local social and economic situation, local government and farmers warmly welcomed it. The project put erosion control using the vetiver system as a key component. Meanwhile, emphasis was also put on economic tree production and water conservation so that farmers could get more direct profit. Now China Vetiver Network is seeking more direct benefit for farmers by vetiver handcraft making, by

providing vetiver pruning or crude process materials to the handcraft factories that have close cooperation with export agencies.