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Finding a Sustainable Way for Coptis Chinensis Cultivation in China

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Abstract: The study demonstrates that the current method of Coptis planting leads to forest destruction. Even with reforestation measures, it leads to the loss of biodiversity in the forest. One sustainable alternative to the current Coptis planting is to incorporate it into agroforestry system. We found that bamboo and fruit trees can be incorporated into the planting of Coptis chinensis during its different growing stages. This not only diversifies villagers' income sources, but also recovers the forest at the same time.

Key words: Coptis % NTFPs % Agroforestry

INTRODUCTION

In conjunction with the increasing global concern about deforestation and rural livelihood, "forests gained heightened appreciation as sources of multiple products and services and as important sources of the livelihood for forest-based people" [1]. As such, forest products are the center of research on forest management, biodiversity, conservation and poverty alleviation [2]. Most of the more than 5,000 commercial forest products are non-timber forest products (NTFPs) [3]. The NTFPs definition from the Center for International Forestry Research (CIFOR) is: "Non-timber forest products (NTFPs) are any product or service other than timber that is produced in forests. They include fruits and nuts, vegetables, fish and game, medicinal plants, resins, essences and a range of barks and fibers such as bamboo, rattans and a host of other palms and grasses" [4].

Coptis is a genus of flowering plant in the family of Ranunculaceae. The most common Coptis species is called Coptis chinensis, which yields much higher output than any other Coptis species and it has been planted as an agricultural product for hundreds of years. Coptis chinensis is one of the most important cultivated medicinal plants in China. The rhizome of Coptis chinensis is also called "Huang Lian" in Chinese or "Chinese gold thread" in English. Berberine, a plant alkaloid, is extracted from Huang Lian and it has demonstrated significant antimicrobial activity against a variety of organisms including bacteria, viruses, fungi, protozoan [5]. The Coptis chinensis land in China are always found to be on the edge of forests, because the current approaches to Coptis chinensis planting require cutting forest trees to provide canopies. Another Coptis species called Coptis teeta is an endangered species itself and its incorporation in agroforestry system benefits both conservation and economic objectives [6]. The Center for International Earth Science Information Network (CIESIN) defines agroforestry as follows: "Agroforestry is a collective name for land use systems and practices where woody perennials are deliberately integrated with crops or animals on the same land management unit" [7]. Based on this definition, the planting mode of Coptis chinensis can hardly be categorized as an agroforestry, because the w ay Coptis chinensis being planted, is similar to most common crops. No official definitions for NTFPs or agroforestry (either written in Chinese or English) can be found in China. However, the whole industry of Coptis chinensis, has been categorized under forestry instead of agriculture by the state government.

Case Study: Shizhu Tujia Autonomous County (Shizhu County hereafter) is a County-level divisions of Chongqing Municipality and it is located in eastern Chongqing, China.

Coptis production in Shizhu County accounts for 60 percent of China's production and 40 percent of that of the whole world. However, the traditional way of planting Coptis was associated with clear-felling of forests to provide Coptis land; it also requires a large volume of timbers for establishing the canopy needed to cover the Coptis plants during its entire 5-year's life cycle. In the meantime, farmers take nutrient-rich forest humus as the main fertilizer for the Coptis. Thus, the Coptis production here has exerted great pressure on natural forests in Shizhu County.

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Fig. 1: Location of Shizhu County in Chongqing Municipality, China (Source: Wikipedia)

Fig. 2: A newly established Coptis field

The previous Coptis planting mode is isolated from forests and its planting leads to destruction of the latter. Local villagers do adopt reforestation by using fast-growing, mono-type trees to replace primary forest trees, which leads to a decrease in tree species richness. The vulnerability of mono-type forests will further weaken the biodiversity in forests. An improved way to cultivate Coptis is to incorporate it into agroforestry by using a variety of local native species to restore mixed woods on Coptis fields. This practice will not only increase biodiversity, but will also reduce the community residents' dependence on the Coptis industry for livelihoods. Under this setup, Coptis chinensis can be categorized as a NTFP and its planting can be incorporated into agroforestry, instead of only exerting negative effects on the forest.

One may ask: "Why don't the farmers just plant Coptis under dense natural forests instead of cutting trees to provide Coptis land and canopy?" Firstly, Coptis needs perennial shade, while unmanaged natural forests cannot guarantee the strict requirement on shade; Secondly, Coptis is unable to compete with the broaden leaf trees for nutrients in natural forest.

One sustainable cultivation method we practiced together with Shizhu County Coptis Company is called "culture of seedlings in bamboo forest". The traditional way of culturing Coptis seedlings requires wood for providing shade. After many rounds of experiments, we found that Chimonobambusa (a species of bamboo) forest as an ideal environment for this practice. A managed

Bamboo Chimonobambusa forest can provide the perfect shady environment needed by Coptis seedlings and it requires much less nutrients and water from the soil than mature natural forest. Another benefit of this method is: it can diversify Coptis farmers' livelihood methods and provide more cash income. Seeding of Chimonobambusa takes place in spring and their bamboo shoots emerge between September and October. Because of their unique morphological characteristics, delicious taste and nutritional value, these bamboo shoots are quite welcomed on the table. By the following spring, the bamboo matures to a normal height between 4-6 m. Mature bamboo can then be cut and made into handcrafts by villagers: another possible income source.

After 2-year's time of culturing Coptis seedlings, Coptis plants need transplantation. At this time, a sustainable solution is to plant Kiwi trees on Coptis field by using their leaves as natural canopy. Though experiments with many species of trees have been done, considering other issues like the economic outcome, the length of growing time, the Kiwi tree is considered as the optimal choice. Kiwi is a liana, which needs the erection of durable frame immediately after being planted in order to facilitate the growth and results. If the setting of frame erection is not in time, seedlings of Kiwi trees will crawl on the ground instead of growing up straight. This will lead to branches being entangled with each other and further affect the formation of the trunk, which ultimately results in delay of the yield of fruits.

The cement columns being used as substitute to woody columns in some Coptis field are ideal frames for Kiwi saplings. A Kiwi sapling can be planted near a cement column and one year later the column can be removed. Branches and leaves of mature Kiwi trees can serve as a natural canopy for Coptis, while harvested Kiwi fruit can be sold by farmers in market for cash revenue.

CONCLUSION

The contradictions between forest conservation and Coptis planting have been shown in this paper. From our experiment, we found that bamboo and fruit trees can be incorporated into the planting of Coptis. It not only diversifies villagers' income sources, but also recovers the forest at the same time. Coptis chinensis planting is now sustainable by incorporating it into agroforestry.

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