

Reforestation rural lands in China pays big dividends, researchers say

11 May 2011



The Chinese government is using economic incentives to encourage farmers to convert millions of acres of steeply sloping cropland back to forest or grassland. Credit: Chris Colvin/Natural Capital Project

An innovative program to encourage sustainable farming in rural China has helped restore eroded forestland while producing economic gains for many farmers, according to a new study by Stanford University researchers.

Their findings are published in the [Proceedings of the National Academy of Sciences](#) (*PNAS*).

"The Sloping Land Conversion Program, which began in 2000 after massive flooding caused in part by land clearing, focuses on China's largest source of soil erosion and flood risk - farms on steep slopes," said study co-author Gretchen Daily, a professor of biology at Stanford.

The program aims to return more than 37 million acres of cropland on steep slopes back to forest or grassland. The government pays villagers in

varying amounts of cash and rice to give up farming and find new sources of employment.

"It's a tremendously innovative program designed to address two critical problems - securing the environment and providing economic opportunities for people in rural, desperately poor areas," said Daily, a senior fellow at the Woods Institute for the Environment and co-director of the Natural Capital Project at Stanford.

Natural capital

The Natural Capital Project has developed a software tool called InVEST that is helping the Chinese government decide where to focus conservation and restoration efforts, based on the potential return-on-investment for society in the form of ecosystem services such as water purification and biodiversity conservation.

"We can think of these life-support services as flowing from natural capital, like forests and wetlands, which provide very tangible, financially valuable services," said Daily. "Forests soak up tremendous amounts of water, filter it and release it gradually into rivers and streams that we use for drinking water, hydroelectric power and growing crops." In many ways, the environment can help mitigate damage from floods and even human disasters, like oil spills, she added.

China's land conversion program has its roots in the late 1960s, when [farmers](#) in the mountainous western provinces began clearing vast stretches of land to make way for more crops. The increased agricultural production helped feed a growing nation but also set the scene for disaster. When record monsoon rains pelted the region in 1998, soil from the agricultural fields washed down the mountain slopes, killing thousands of people in the villages below.

The unprecedented damage caused by the floods

prompted [China](#) to reconsider the wisdom of replacing forests with farms - especially in steeply sloping terrain. In 2000, the government launched a campaign to reforest the countryside and established several large-scale programs to help farmers in the western provinces find new work in surrounding cities.

In the *PNAS* study, Daily and colleagues from Stanford and Xi'an Jiaotong University evaluated the land conversion program - one of the oldest and largest government projects associated with the reforestation push. The study is one of the first to assess whether this major government effort has reached its twin objectives of improving the environment and lifting people from poverty in rural mountain regions.

A passing grade

Ecologically speaking, China's Sloping Land Conversion Program has been a clear win since it was implemented a decade ago, said Daily, noting that the program has helped to decrease [soil erosion](#) by as much as 68 percent in some areas.

But economically, the benefits have been less pronounced, according to Jie Li of Xi'an Jiaotong's School of Public Policy and Administration in China. He is the lead author of the *PNAS* study that assessed the economic effects of the land conversion program by analyzing the response to survey questions posed to 929 villagers in the western provinces.

On average, families that participated in the program reported doing better financially than those who did not, but some farm workers had trouble finding new work, according to the study. Households that profited most did so by sending a husband-and-wife team into the city to earn money as unskilled laborers. The wages they earned in the city combined with the government subsidy easily topped what they had earned as farmers.

But not all families were able to send both parents to the city, because they had no one to care for their child while they were away.

"In many cases, it came down to whether or not the

grandparents lived with the family and were available to look after the couple's one, maybe two, children," said study co-author Marc Feldman, professor of biology and director of the Morrison Institute for Population and Resource Studies at Stanford.

Fine-tuning

The researchers' evaluation of the sloping land conversion program has provided feedback to the Chinese government that will be used to fine-tune the system for calculating subsidy payments in the future, said Daily. For example, some families may require bigger subsidies or other assistance, like special permission to enroll their children in city schools where they work.

"It's highly unusual for any government to check the effectiveness of a program like this so rigorously," said Daily. "We're fortunate to have an opportunity to evaluate an operation of this magnitude and learn lessons for other parts of the world."

Last October, Daily witnessed the scope of the flooding problem firsthand. She and her research team were assessing forest habitat on the tropical island province of Hainan when torrential floods swept through the region. The roads were already disappearing under a wash of mud as the researchers made their way to the airport to escape the rising waters. "The rivers burst their banks, and mud was flowing in wide sheets through rubber plantations and across cropland and roads and in towns," she recalled. But in a nearby natural forest reserve, where she'd been just 12 hours earlier, the water was perfectly clear.

"So many people died in those floods or lost everything they owned," she said. "The importance of protecting these ecosystems has always resonated with me on an intellectual level, but this hit me on an emotional level."

For China, the devastating floods of 1998 were a wake-up call that caused people to think about the value of natural ecosystems in a new way, she added. "I'm hopeful that we, too, will reconsider the value of our natural capital, especially in the wake of disasters like Katrina and the BP oil spill."

Provided by Stanford University

APA citation: Reforesting rural lands in China pays big dividends, researchers say (2011, May 11)

retrieved 21 October 2021 from <https://phys.org/news/2011-05-reforesting-rural-china-big-dividends.html>

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