

II. Economics

With China's Exemplary Fight Against Desertification, 'Trees Are Forcing Sand To Retreat'

by Karel Vereycken

Sept. 12—*Karel Vereycken, artist and infrastructure journalist, is based in Paris, with the Schiller Institute. This article is adapted from his article published in China in Summer 2024, among contributions for the "Written in the Sky, My China Story" series, in commemoration of the 75th anniversary of the founding of the People's Republic of China.*

The figures are beyond impressive. A survey made in 2019 by China's National Forestry and Grassland Administration (NFGA) reported that, despite the huge efforts in favor of land rehabilitation since 1978, still 2.57 million square kilometers, representing 26.8% of the country's land area, remain desert areas. Over the last 40 years, 15% of China's land turned into desert. Sandstorms regularly sweep over the country, from Mongolia to Beijing, damaging both infrastructure and food production. Desertification and land degradation are among the most severe threats facing China, affecting over 400 million people.

But there is more. China has a large population. It has to feed 22% of the world's population with only 10% of the world's arable land. Even with increasing crop yields per hectare and livestock productivity, the country's annual food import bill grew from \$49 billion in 2013 to \$139.62 billion in 2022, registering an annual rate of increase of 12.3%. Even discounting this for inflation, and for imports to deliberately improve the diet, China still depends on

foreign-produced food. Therefore, transforming deserts into valuable farmland and preventing sandstorms are an existential challenge. "Desert control" is on the national agenda.

This year is a milestone moment for this goal. On June 17, 2024, the world's 30th Desertification and Drought Day, and the 30th anniversary of the adoption of the United Nations Convention to Combat Deserti-



Mixed species afforestation, shown here in Dongying, helps improve pest resistance and creates varied form and coloration.

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fication (UNCCD), Chinese Foreign Ministry spokesperson Lin Jian could proudly announce that China was the first country in the world to achieve zero net land degradation and to reduce both desertification and "sandification." China is making a major contribution to meeting the global goal of zero net land degradation by 2030.

From 2009 to 2019, desert land area in China saw

a net decrease of 50,000 km², a significant change compared with an expansion of 3,436 km² per year in desertified land at the end of the last century. According to China's NFGA, forest and grassland vegetation in key project areas has been effectively restored after a long period of land-management intervention, and the key management areas have achieved an historic transformation from a condition of "sand forcing humans to retreat," to "trees forcing sand to retreat." Turning an enemy into an ally, agricultural and economic expansion in these former desert areas is now called "sand mining."

'Sand Mining'—How Did It Happen?

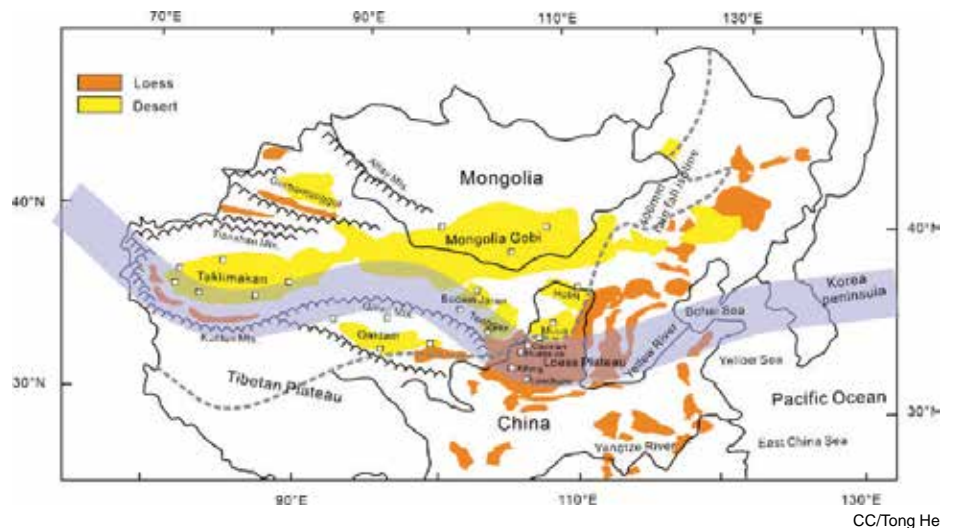
Today's achievement is the fruit of a long battle. In November 1978, the Central Committee of the Chinese Communist Party and the State Council decided to launch a 72-year project (1978-2050) to combat desertification, called the Three-North Shelterbelt Program (TNSP).

The basic idea was to create a series of human-planted, wind-breaking forest strips (shelterbelts) along China's Great Wall, this time designed to hold back, not the Mongols, but the expansion of the Gobi Desert, and to provide timber to the local populations. The Gobi, meaning the "waterless," is Asia's largest and the world's fifth-largest desert. It can be very hot and extremely cold. It is believed to have only 5% sand; the rest is bare, hard rock with some barren steppes, grassy steppes, and tall mud cliffs.

Added to this, in Xinjiang's endorheic Tarim Basin is another monster, the Taklamakan Desert. It is the world's second-largest "shifting sand" desert—its sand is always in motion, like oceanic waves. It's called "The Desert of Death," which means "go in, and you will never come out."

The total length of what Deng Xiaoping (leader of China, 1978-1989) called in 1988 "The Great Green Wall" is planned to reach 4,500 km. The program involves 551 counties in 13 provinces and covers a total area of 4,069,000 km², more than 40% of China's territory.

Over the past thirty years, millions of hectares [a



The extent of desert in China and the wind pattern (in blue).

hectare is just under 2.5 acres—ed.] of windbreaks and dune-fixation forests have been established to restore and protect more than 10 million hectares of grassland and pastures from wind erosion and silting. This program has involved thousands of forestry officials, supported by citizen and private initiatives.

Each year, on March 12, all Chinese citizens go out and plant trees. One private citizen, Mme. Yin Yuzhen, whose efforts have been presented as a model by President Xi Jinping, took it upon herself to singlehandedly plant trees to rehabilitate the desolate environment in Uxin Banner (county), which is the semi-arid area in the southwest of the Inner Mongolia Autonomous Region of China.

With all this energy and effort, several hundred thousand square kilometers of silting land have been managed and converted into farmland, orchards, and pastures. One study estimates that windbreaks around farmland have led to a 15-20% increase in grain production, amounting to a surplus of 1.88 billion kilograms each year. The yields of grain production in the restored areas have now exceeded 300 kg/mu (666.5 square meters), up from just 100 kg/mu before the program began.

Creativity and Innovation Are Key

Over the decades, China has kept exploring new technologies and innovative methods to take up this challenge. The list of technologies and methods include:

- Aerial seeding when possible, in semi-desert areas;
- Rigorous remote satellite desert monitoring;
- "Straw Checkerboards," a technique in which straw



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Experts confer in a greenhouse for seedlings of saline-resistant trees developed by Chinese scientists.

is placed on the desert surface in the shape of a checkerboard to prevent the sand from moving;

- “Desert Soilization,” consisting of applying a paste of plant cellulose and sand, allowing the desert surface to maintain water, air, and fertilizer;
- The use of “Liquid Nano Clay (LNC),” a mixture of water and nanoparticles of clay, that can turn dry and sandy dirt into water-retaining arable soil;
- “Lab-Cultured Cyanobacteria” to form biological soil crusts on the surface of the sand, which can cut the crust formation time from 10 years to only one year;
- Drip and sub-film drip irrigation and fertigation;
- AI-powered automated seeding machines;
- Walk-behind “paving” machines to more efficiently “plant” straw nets;
- Precise sand-control methods, such as adjusting the density of afforestation according to the capacity of local water resources, avoiding the decline of young and medium-sized trees.

As of today, the TNSP has completed a total of 320,000 km² of afforestation, and the treatment of 0.85 million km² of degraded grassland, with the forest coverage rate increasing from 5.05% in 1978 to nearly 14% now. As a result, China, with 211 million hectares, has today the world’s fifth-largest forest, even if that constitutes only 22.1% of its total land area.

Learning from Errors

While the program has undeniably proved its worth in terms of land restoration, its implementation has been fraught with errors and pitfalls. The obstacles overcome over the decades provide a set of lessons that add value to the Chinese experience. For example, the choice of vegetation type (particularly in terms of its depth of rooting), the choice of species (endemic or imported), their diversity, the density of the cover, etc., were all factors that had to be adjusted to local ecological conditions, and to the nature of specific rainfall or soil-water resources.

The optimum combination of various biological measures and land restoration techniques was also an important factor in the success of the project: wind-breaks, artificial planting, fencing of pastures to allow natural regeneration, aerial seeding, water and soil conservation techniques.

China learned much from its mistakes, while those doing nothing new learn nothing new. Very rapidly, it turned out that the “one solution fits all” was the wrong approach. A trial-and-error policy had not only to be accepted, but was essential for success.

For example, in the early stages, millions of poplar trees were planted, because they offered rapid results in terms of timber. But many of them did not survive for very long, because poplars need a huge amount of



China Nat'l Forest and Grassland Administration

Phases of the Three-North Shelterbelt Program (TNSP). China's vast forest-growing program is a nationwide effort involving the citizenry.

water! Another telling story is from a village from Inner Mongolia where tree seedlings were planted and the next day were blown away. “We managed to keep a few saplings, but, due to the drought and lack of rain, they struggled to survive for a second year,” reported a local official. After rounds of failure, he found that the wild apricot trees on the barren mountain survived the wind and sand again and again. “Mountain apricot is drought-resistant, cold-resistant and has strong adaptability. It is an excellent native tree species for sand fixation and water conservation. People can enjoy flowers in Spring and fruit in Summer, so it has economic value,” he said. In 2012, he led his village to plant more than 60,000 mountain apricot trees. After years of preservation, the trees have protected the village from sandstorms. With support from the forestry department, the village has planted 17 varieties of fruit trees and medical plants to diversify sources of income.

The Water-Energy-Food Nexus

Of course, efficient water management and modern irrigation techniques will play a key role rolling back the desert. Water, energy, and food are so interdependent that you can't achieve anything durable in one of them without advancing the other factors.

During his presentation at the Paris Schiller Institute January 2024 [Conference on Water for Peace](#), Chinese water expert Professor Yungang Bai gave a stunning

status report on the latest achievements in terms of water-saving technology in the arid area of Xinjiang.

Chinese scientists discovered in 2015 that, hidden under the Tarim Basin, there could be a “terrifying amount of water”—and even “an ocean,” whose amount of water is equivalent to 10 times the water in all five Great Lakes in North America—it remains unclear how that water can be tapped. So, for the time being, the total water resources reported accessible in Xinjiang account for only 3% of the total of all of China, and agricultural water use in the region accounts for more than 91% of the total water supply.

Water-saving techniques are, of course, not new in this region. Pro-

fessor Yungang reported that, just as in Israel's Negev desert, traditional irrigation techniques such as inundation and sprinkling are being carefully replaced in Xinjiang by drip irrigation, and even better, “sub-film” drip irrigation and “fertigation.” He reported, “With the large-scale promotion and application of water-fertilizer integration technology, the scope of application has gradually been expanded from cotton, corn and wheat to forest fruits, vegetables, melons and other crops. The advantages of the water-fertilizer integration technology are mainly reflected in “Three Savings, One Increase,” namely, water saving, fertilizer saving, land saving, and yield increase. Compared with traditional methods, the water utilization rate of this technology is increased by 40-60%, the fertilizer utilization rate is increased by 30-50%, the land utilization rate is increased by 5-7%, the irrigation guarantee rate is increased by more than 15%, and the grain crop yield is increased by 20-50%.

Hence, increasing water availability, and therefore access to food, will of course equally depend on the increased availability of cheap and safe energy. In remote areas, where it is hard to connect to a grid, solar energy can play a positive role. But its low density and intermittence, without a hydro-power generation system to compensate, make it unreliable for making the transition to an industrial society.



UNEP/Xinwen Xu

A Great Green Wall team of African agronomists visiting the 436-km Taklamakan Desert highway green wall, seen here reaching into the distance, in Xinjiang in 2017.

With China developing 4th-generation, small modular nuclear reactors (SMRs), its heroic fight

against desertification will soon mark new records, since such technology will allow the desalination of brackish water resources untapped so far, and transform land currently considered unfit for production into valuable farmland. Under many deserts, there do exist deep aquifers whose waters are too saline to be used in their natural state. Building SMRs in the desert can offer solutions.

Water for Peace

While taking the lead in combating desertification over the past decades, China has extensively carried out international exchanges and cooperation, sharing its experience with countries that face similar challenges, notably in Africa. Since 2005, researchers from Xinjiang Institute of Ecology and Geography (XIEG) of the Chinese Academy of Sciences have been sharing mature desertification-control technologies with Central Asia and Africa through workshops and field practice. In Central Asia, Uzbek scientists have long collaborated with Chinese scientists in seeking solutions for the Aral Sea Basin: Once the world's fourth-largest lake, the Aral Sea shrank following bad irrigation management. Over the years, scientists from both sides have set up several demonstration zones for practicing water-saving methods in fields; they have introduced various water-saving technologies to the region.

China has been actively fulfilling its obligations under the UNCCD, establishing an International Knowledge Management Center on Combating Desertification in Ningxia in December 2019. This Center aims to share China's wisdom and experience in combating desertification with other countries all over the world.

Therefore, it should be recognized, and in a much better way than with empty words, that Chinese actions to combat desertification merit the highest respect. They are creating the conditions not only for a prosperous China, but for a world of peace.



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