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Perspectives

How to cite:

Zhang, Ling. "The Journey of Sand: How the Yellow River Has Shaped Lankao County." In: "Asian Environments: Connections across Borders, Landscapes, and Times," edited by Ursula Münster, Shiho Satsuka, and Gunnel Cederlöf, *RCC Perspectives* 2014, no. 3, 11–16.

Rachel Carson Center for Environment and Society
Leopoldstrasse 11a, 80802 Munich, GERMANY

ISSN 2190-8087

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Federal Ministry
of Education
and Research

Deutsches Museum

LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

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The Journey of Sand: How the Yellow River Has Shaped Lankao County

Land desertification and sandification have become a major environmental problem in the world. The problem is particularly severe in China. According to the statistics from China's State Forestry Administration, by the end of 2009, China had a desertified land area of 2,623,700 square kilometers (27.33 percent of the total national territory) and a sandified land area of 1,731,100 square kilometers (18.03 percent of the total national territory). Given the country's 1.4 billion, ever-enlarging population, the increasing loss of habitable and cultivable land to encroaching deserts and sand seriously threatens China's land productivity, food security, and its long-term social, strategic, and ecological sustainability. The urgency of this problem has driven Chinese environmental scientists to carry out extensive studies on land degradation. It has urged the state to legislate for land protection and prompted the government and society, as well as various NGO groups, to make efforts in reforesting China's denuded land.

As significant as it is, the desertification and sandification issue has not attracted much scholarly attention among Chinese historians. How did so much land become sandified over time? What caused the process? What roles did human activities play during the course of sandification? How has such land degradation affected the social, economic, and political life of people in China? These questions, which environmental historian Donald Worster investigated in *Dust Bowl* (1979) to understand the sandification of the Great Plains in the US in the early twentieth century, offer profound insights into the understanding and handling of land degradation. They should be raised and examined in the heavily desertified China.

As a preliminary effort to approach the Chinese history of desertification and sandification, I am introducing a peculiar kind of sandification—the historical interactions between the environmental degradation in the upper stream areas of the Yellow River drainage and the gradual sandification of many parts of the North China Plain along the river's lower stream. The Yellow River has extraordinarily high silt contents, which serve as the main source of incoming sand in north China. While other sources of sandification (e.g., the Gobi in Inner Mongolia and Xinjiang) deliver sand across northern China by wind, the Yellow River transports sand by water in the form of silt during its

frequent floods and changes in course. Previous historical studies of the Yellow River usually see the flooding water as the river's major disastrous phenomenon. However, I argue that most disasters bring about a cluster of side effects—other forms of disaster. In the Yellow River's case, its water not only floods the land, causing damage to the livelihoods of local people, but also enables the movement and accumulation of sand, thereby initiating and sustaining the process of sandification. Localities and their inhabitants are doubly affected by the Yellow River: first by water and then, in the long run, by silt-turned-sand. Unlike most cases in the world, where desertification and sandification occur mainly because of the shortage of water, the sandification associated with the Yellow River in the North China Plain results from the complex hydrodynamics between water and sand, and sometimes from too much water.

This paper approaches the history of the Yellow River-produced sandification by focusing on a specific locale that has been seriously affected by sandification and, from this locale, tracing the journey of the sand's movement. It starts in Lankao County, where an enormous amount of sandy material has been deposited after traveling thousands of kilometers through the Yellow River. Located in northern Henan Province, Lankao presently covers an area of 1,116 square kilometers. The land is low-lying and flat, and the soil has long been known for its heavy sandy cover, for constantly provoking sandstorms, for its high saline content, and for its sterile quality. On account of these factors, agriculture failed constantly and the population kept shrinking. This unfortunate situation worsened in the early years of the present communist regime and prompted the local leadership to launch a campaign to "manage sand" as a part of the nationwide economic campaign: the Great Leap Forward. The severe environmental conditions and the county's pressing need to cure the problems gave rise to the sand-managing hero Jiao Yülu, who was the county magistrate in the early 1960s. Jiao died from liver cancer during his short tenure as the leader of the campaign. His tragic death has gained him posthumous fame for his revolutionary spirit in battling the hostile environment, which makes him an icon not only in Lankao but also across China. His death also seems to have bound Lankao and sand together eternally.

In the early 1980s, even after two decades of the campaign and intensive reforestation efforts, Lankao still had a large number of sandy areas (37.6 percent of its entire area). In 2006, the situation became worse: 62 percent of its land was reported to be sandified. Without land survey records, the situation in Jiao Yülu's time cannot be quantified.

Dried silt on the bank of the Yellow River. (Courtesy of the author.)

I suspect it must have been worse before the sand-managing campaign showed results. My questions are: Where did the sand come from and what effect did it have on the landscape of Lankao? Research shows that most of the sand came from the Loess Plateau in the northwest, thousands of kilometers away from Lankao, and traveled through the stream of the Yellow River. This journey of sand spanned not only a vast distance but also a long time—about nine centuries. Today, the lower reaches of the Yellow River flow through the northern part of the county. But before the twelfth century, the river barely touched this land. From the mid-twelfth century, the river shifted and began penetrating the territory of Lankao County. Records show 120 cases of river flooding from the late thirteenth century until 1949, when the People's Republic of China was established. These floods were disasters for local people, damaging their fields and buildings, and even causing the drowning and abandonment of whole areas. On many of these occasions the river shifted around, creating multiple river courses or leaving behind dry, abandoned riverbeds on the land surface. Known as "China's sorrow," the Yellow River was truly a chronic pain for Lankao.

Water, indeed, is the major component of a river and the major force causing flooding disasters. But in the Yellow River's case, water is not the sole troublemaker. Silt carried

by the river's water usually leads to long-lasting, even permanent destruction. The Yellow River has been known for its heavy silt content and muddy flow for 2,000 years. In recent decades, it has carried 1.6 billion tons of silt annually, at a rate of 34.8 kg per cubic meter of water. This is in sharp contrast to rates of other rivers with heavy silt loads, such as the Ganges at 3.9 kg/m^3 and the Colorado at 27.5 kg/m^3. At the peak of its flood and silt discharge, the Yellow River's silt-water rate may surge to 900 kg/m^3. Ninety percent of this silt comes from its middle reaches, where the river courses through southern Inner Mongolia and the Loess Plateau, and forms the "Great Bend." This area features an enormous plateau formed by loose, porous loess, sandy gravels, and deserts of various sizes. Its loess and sand are easily washed down by rain or blown by wind into the Yellow River, thus filling the water with silt.

A survey of the river's history shows that the environmental conditions in the river's middle reaches have affected the river's silt load. The increase in population, the expansion of agricultural colonies, the surge in deforestation, the changes in climate, and the advancement of deserts have accelerated soil erosion in this area and thereby the siltation problem in the river. These problems have rapidly become more acute since the seventh century; as a result, the river's lower reaches became more and more turbulent, and its course shifts and flooding have increased since the tenth century. It also explains why parts of the river shifted into the territory of Lankao in the twelfth century and triggered the long-term process of sandification.

From the Loess Plateau and the river's Great Bend, sandy silt begins its long journey toward the North China Plain. It winds through the earthen gullies in northern Shaanxi and rushes down to the south through the rocky mountains between Shaanxi and Shanxi. After bursting out from the mountains in central China, it enters north China's vast, flat plain. Here, the riverbed opens up widely. Its water flow slows down and so does the pace of silt, which starts to be deposited along the next 800 kilometers of the river's course. About 40 percent of the river's silt load does not enter the sea, but rather is unevenly deposited in the riverbed and spread over the river's floodplains, including places like Lankao. Over centuries, silt keeps building up in the riverbed, forcing the water to rise. As a result, the riverbed is elevated above the surrounding land, causing it to become a "suspended river" or "raised river bed." Throughout history, the Chinese responded to this problem by building dykes (today there are 1,370 kilometers of dykes along the river's 768-kilometer-long lower reaches), which confined both water

and silt within the limited space and prevented them from spreading freely towards the surrounding plains. This particular technical solution has had negative consequences—siltation in the riverbed has worsened and flooding has increased. If any section of the dykes fails, the bank ruptures and flooding instantly occurs, pouring torrents of water, together with heavy silt, into the surrounding lowlands.

Flood water penetrates the ground or, given some time, evaporates. Silt, however, has nowhere to go and has to settle on the land surface. In the Yellow River's case, its silt consists of fine sand, coarse sand, and rocky, stony debris. These sandy materials cover the ground, replace the topsoil of arable land, and bury buildings and roads. In serious circumstances, a single flood may end in the immediate deposit of silt up to one meter high, which can ruin an entire city or village. In Lankao, the Yellow River's activities over the past nine centuries have produced numerous sandy patches, multiple dry riverbeds, and sandy bars. Long-standing human activities (such as farming and cutting down trees and grass for fuel) have not helped to retain the moisture in the soil needed to allow the sandy materials to decompose and gain nutrients, or to allow the sand to be shielded by plants and fastened by their roots. According to historical sources, including various accounts by local gazetteers, Lankao began to witness sandification as early as the fourteenth century. By the mid-twentieth century, the landscape in this area appeared so desolate that meters-high sand dunes spread throughout the land and, given a little wind, loose sand was blown away and whirled about in the air.

Lankao is certainly not the only destination where the Yellow River's sandy silt stops and settles. Wherever the river passes by, we shall find its silt and its effects on the land. This brief case study brings to our attention the historical evolution of the association between the Yellow River and sandification, one of the most alarming environmental problems in north China. It suggests that such an environmental problem is neither a modern issue nor a local one.

Further Reading

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