

Reversing China's Harvest Decline

The phenomenal rise in China's grain production from 90 million tons in 1950 to 392 million tons in 1998 was one of the great economic success stories of the late twentieth century. But in 1998 production peaked and turned downward, falling to 322 million tons in 2003. As noted in Chapter 1, this drop of 70 million tons exceeds the entire grain harvest of Canada. Thus any attempt to expand the world grain harvest enough to rebuild depleted world grain stocks starts with reversing the decline in China.¹

Virtually all of China's production decline of nearly 18 percent from 1998 to 2003 is the result of a 16-percent shrinkage in grain area. Several forces are at work here, as described in Chapter 5. Cropland is being converted to nonfarm uses at a record rate, including industrial and residential construction and the paving of land for roads, highways, and parking lots. With deserts expanding by 360,000 hectares (1,400 square miles) a year, drifting sands are covering cropland in the north and west, making agriculture impossible. The loss of irrigation water is also reducing the harvested area, particularly of wheat, which is grown in the northern, drier regions of the country.²

In 2004 China's improved grain harvest, lifted by a

substantial rise in the rice support price and unusually favorable weather, was expected to regain 21 million of the 70-million-ton-drop of the preceding five years. Even with this projected production increase, China's harvest in 2004 will still fall short of consumption by 35 million tons. And there are several worrying trends that undermine the hope that the harvest will rise consistently again anytime soon.³

Grainland Shrinking

Chapter 1 described “the Japan syndrome,” a set of interacting trends that explain why grain production declines in countries that are already densely populated before they industrialize. Each of the three countries discussed—Japan, South Korea, and Taiwan—had virtually identical experiences. In short, as industrialization gains momentum, grain consumption and grain production both rise, more or less together. In a relatively short time, however, grain planted area begins to shrink as farmland is converted to nonfarm uses, as grain is replaced by higher-value fruit and vegetable crops, and as the migration of farm labor to the cities reduces double cropping. This shrinkage in grain area then leads to declining grain production.⁴

China is facing precisely the same forces that within three decades cut grain harvests by one third to one half in Japan, South Korea, and Taiwan. But China's challenge is even greater because it is also losing grainland to expanding deserts and it is faced with spreading water shortages that are shrinking the grain harvest—problems the other three countries did not have.

China's deserts are advancing as its 1.3 billion people and 404 million cattle, sheep, and goats put unsustainable pressure on the land. Indeed, desert expansion has accelerated with each successive decade since 1950. The Gobi is marching eastward and is now within 150 miles

of Beijing. Some deserts have expanded to the point where they are starting to merge. Satellite images show the Bardanjilin in north-central China pushing southward toward the Tengry desert to form a single, larger desert, overlapping Inner Mongolia and Gansu provinces. To the west in Xinjiang province, two much larger deserts—the Taklamakan and the Kumtag—are also heading for a merger.⁵

Wang Tao, Deputy Director of the Cold and Arid Regions Environmental and Engineering Research Institute, the world's premier desert research institute, reports that on average 156,000 hectares were converted to desert each year from 1950 until 1975. From 1975 to 1987, this increased to 210,000 hectares a year. But in the 1990s, it jumped to 360,000 hectares annually, more than doubling in one generation.⁶

The human toll is heavy, but rarely is it carefully measured. Wang Tao estimates that 24,000 villages “have been buried [by drifting sand], abandoned or endangered seriously by sandy desertification” affecting some 35 million people. In effect, Chinese civilization is retreating before the drifting sand that covers the land, forcing farmers and herders to leave. Most of this abandonment has come over the last two decades.⁷

Overplowing and overgrazing are converging to create a dust bowl of historic dimensions. With little vegetation remaining in parts of northern and western China, the strong winds of late winter and early spring can remove literally millions of tons of topsoil in a single day—soil that can take centuries to replace. For the outside world, it is dust storms like the ones described in the beginning of Chapter 5 that are drawing attention to the deserts forming in China.

The removal of small soil particles by wind in dust storms marks the early stages of desertification. This is

followed by sand storms as desertification progresses. The growing number of major dust storms, as compiled by the China Meteorological Administration, indicates how rapidly this is happening. After increasing from 5 in the 1950s to 14 during the 1980s, the number leapt to 23 in the 1990s. (See Table 8–1.) The current decade began with more than 20 major dust storms in 2000 and 2001 alone.⁸

While overplowing is now being partly remedied by paying farmers to plant their grainland in trees, overgrazing continues largely unabated. China's cattle, sheep, and goat population tripled from 1950 to 2003. While the United States, a country with comparable grazing capacity, has 96 million cattle, China has a slightly larger herd of 103 million. But for sheep and goats, the figures are 8 million versus a staggering 317 million. Concentrated in the western and northern provinces of Inner Mongolia, Xingjiang, Qinghai, Tibet, and Gansu, sheep and goats are destroying the land's protective vegetation. The wind does the rest, removing the soil and converting grassland into desert.⁹

Even as overgrazing destroys forage, the number of sheep and goats continues to increase. While China's cat-

Table 8–1. *Number of Major Dust Storms in China, by Decade, 1950–99*

| Decade | Number |
|---------|--------|
| 1950–59 | 5 |
| 1960–69 | 8 |
| 1970–79 | 13 |
| 1980–89 | 14 |
| 1990–99 | 23 |

Source: See endnote 8.

tle herd has scarcely doubled since 1950, the number of sheep has nearly tripled and goat numbers have quintupled. The disproportionate growth of the goat population is a telltale sign of a deterioration in forage quality, a shift that favors the hardier goats.¹⁰

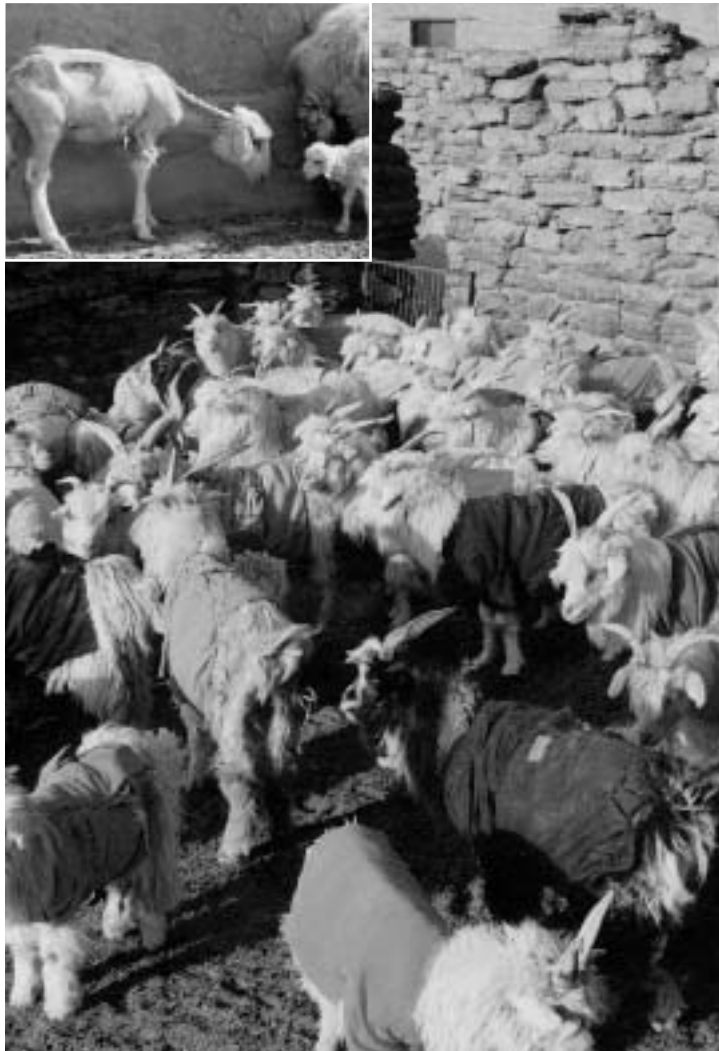
Millions of rural Chinese are being uprooted and forced to migrate eastward as the drifting sand covers their cropland. Expanding deserts are driving villagers from their homes in Gansu, Inner Mongolia, and Ningxia provinces. An Asian Development Bank assessment of desertification in Gansu Province reports that 4,000 villages risk being overrun by drifting sands.¹¹

A report by a U.S. embassy official in May 2001 after a visit to Xilingol Prefecture in Inner Mongolia (Nei Mongol) notes that the prefecture's livestock population climbed from 2 million as recently as 1977, just before the economic reforms, to 18 million in 2000. With the economic reforms, the government lost control of livestock numbers. A Chinese scientist doing grassland research in the prefecture notes that if recent desertification trends continue, Xilingol will be uninhabitable in 15 years.¹²

The U.S. Dust Bowl of the 1930s forced some 2.5 million "Okies" and other refugees to leave the land, many of them heading from Oklahoma, Texas, and Kansas to California. But the dust bowl forming in China is much larger, and during the 1930s the U.S. population was only 150 million—compared with 1.3 billion in China today. Whereas the U.S. flow of Dust Bowl-refugees was measured in the millions, China's will be measured in the tens of millions.¹³

While the deserts are expanding, so too are the cities. With the fastest economic growth of any country since 1980, the voracious land hunger in the residential, industrial, and transportation sectors is consuming vast areas of land—much of it cropland. The sheer size of China's

Mohair goats, deprived of adequate forage as grasslands deteriorate, graze on each other. Herders wrap their goats in discarded clothes to protect them. Inset: A goat with all its hair eaten by other poorly nourished goats. Photo: Lu Tongjing.



population of 1.3 billion is impressive, but even more impressive is the fact that 1,193 million of them live in 46 percent of the country. The five sprawling provinces of Tibet, Qinghai, Xinjiang, Gansu, and Inner Mongolia, which account for 54 percent of the country's area, have only 81 million people—just 6 percent of the national total. (See Figure 8–1.) Thus industrial and residential construction and the land paved for roads, highways, and parking lots will be concentrated in less than half of the country, where 94 percent of the people live. People are crowded into this region simply because this is where the arable land and water are.¹⁴

Local government enthusiasm for establishing development zones for commercial and residential buildings or industrial parks in the hope of attracting investment and jobs is consuming cropland at a record pace. The Ministry of Land and Resources reported in early 2004 that some 6,000 development zones and industrial parks cover some 3.5 million hectares. In 2003, the Ministry of Land Resources reported the conversion of a record 2.1 percent of cropland to nonfarm uses, alarming political leaders in Beijing.¹⁵

Cars, as mentioned earlier, are also taking a toll. Every 20 cars added to China's automobile fleet require the paving of an estimated 0.4 hectares of land (1 acre, or roughly the area of a football field) for parking lots, streets, and highways. Thus the 2 million new cars sold in 2003 meant paving over 40,000 hectares of land—the equivalent of 100,000 football fields. If this was cropland, and most of it probably was, it could have produced 160,000 tons of grain—enough to feed half a million Chinese.¹⁶

If China had Japan's automobile ownership rate of one car for every two people, it would have a fleet of 640 million, a fortyfold increase from the 16 million cars of



Figure 8–1. *Geographic Distribution of Population in China, 2002*

today. Such a fleet would require paving over almost 13 million hectares of land—again, most of it likely cropland. This figure is equal to nearly two thirds of China’s 21 million hectares of riceland—land that produces 120 million tons of rice, the country’s principal food staple. When farmers in southern China lose a hectare of double-cropped riceland to the automobile, rice production takes a double hit.¹⁷

Farmers throughout China are also converting grainland to higher-value harvests. In a country where farms average 0.6 hectares (1.6 acres), the only readily available option for boosting income for many is to shift to higher-value crops. In each of the last 11 years, the area in fruits

and vegetables has increased, expanding by an average of 1.3 million hectares per year. This jump in area from 10 million hectares in 1991 to 26 million hectares in 2003 (see Figure 8–2) included hefty increases in asparagus, cabbage, carrots, cauliflower, peppers, eggplant, garlic, onions, spinach, watermelons, tomatoes, apples, pears, and grapes. The huge expansion is in response to rapid growth both in domestic demand (as incomes rise and diets diversify) and in the export market. High-value, labor-intensive export crops are well suited to a country where labor is by far the most abundant resource.¹⁸

In the more prosperous coastal provinces, the migration of farmworkers to cities has made it more difficult to double crop land. For example, the once widespread practice of planting wheat in the winter and corn as a summer crop depends on quickly harvesting the wheat as soon as it ripens in early summer and immediately preparing the seedbed to plant the corn. But with mil-

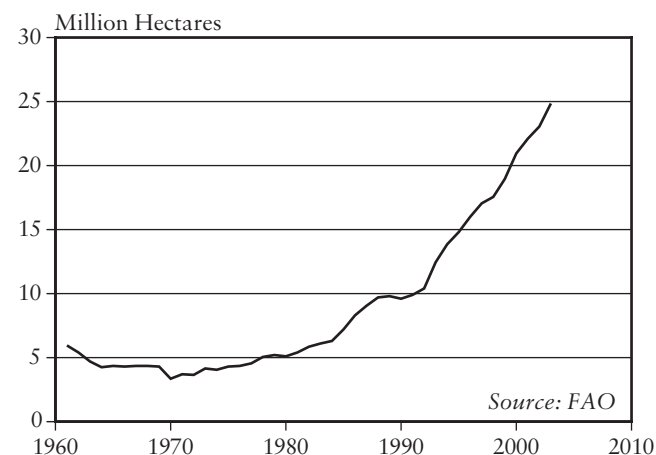


Figure 8–2. *Vegetable and Fruit Harvested Area in China, 1961–2003*

lions of younger workers moving to cities in search of jobs, many villages no longer have enough able-bodied workers to make this quick transition, and the double-cropped area is reduced.

Reversing the fall in grain production will not be easy simply because growth in the activities that are claiming cropland is so relentless. Reversing any one of these trends—conversion to nonfarm uses, desert expansion, the decline in multiple cropping—will take an enormous effort. While higher grain prices may temporarily increase multiple cropping and boost production, China faces an uphill battle in sustaining growth in its grain harvest for the same reasons that Japan, South Korea, and Taiwan did.¹⁹

The new economic incentives introduced by Beijing in early 2004 to boost grain production may modify some of these trends in the short run. For example, higher support prices for rice and wheat may slow the movement of rural labor into cities. They also encourage farmers to invest more in inputs, such as fertilizer and pest control. And if adoption of the new incentives coincides with unusually favorable weather, a modest, short-term upturn in grain production can occur, as it did in 2004. But restoring sustained growth in the grain harvest will challenge the leadership in Beijing.²⁰

An Aquacultural Initiative

One of China's responses to land and water shortages has been to vigorously expand aquacultural output, taking advantage of this grain-efficient form of animal protein. Although fish farming goes back some 3,000 years in China, annual aquacultural output did not reach 1 million tons until 1981, shortly after the 1978 economic reforms. It then began to expand rapidly, climbing from 1 million tons in 1981 to 28 million tons in 2002.²¹

China's fast-growing aquacultural sector totally dominates world aquaculture. Indeed, as of 2002, China produced 28 million tons out of the world aquacultural output of 40 million tons, accounting for more than two thirds of the global total.²²

Within China, the area used for aquaculture production, both fresh water and offshore, totals some 6.8 million hectares—roughly the size of Ireland or West Virginia. This area consists of farm-built ponds; reservoirs, including many smaller ones used for water storage; and the offshore areas occupied by cages. China has some 800,000 cages used for fish production that are near offshore.²³

Carp dominate China's output, at nearly 13 million tons—almost half of the 28-million-ton annual harvest. Other freshwater fish, including tilapia, push the freshwater finfish total to 15 million tons. There are also more than 5 million tons of oysters, mussels, and scallops produced, including both freshwater and saltwater species. The remaining 8 million tons consists of a variety of species, including crab, prawn, and eel.²⁴

As China's aquacultural output has grown, it has spawned a huge aquafeed industry, totaling 16 million tons in 2003—11 million tons of grain and 5 million tons of soybean meal. Freshwater fish rations are now roughly one third soybean meal, substantially higher than the 18–20 percent soybean content in livestock and poultry feeds. Traditionally, fish feeds relied heavily on fish meal to achieve the optimum protein content, but with fish becoming scarce, soybean meal has proved to be a readily acceptable substitute for China's largely omnivorous fish species.²⁵

Consumption of farmed fish per person is easily two times higher in cities than in the countryside. Because cities are dispersed, so too is fish farming. Most of the fish are produced by small farmers who typically build their own ponds or use local reservoirs.²⁶

The extraordinary growth in China's aquacultural output is largely the result of strong government support for the industry. China is also exporting substantial quantities of aquacultural products. The U.S. agricultural attaché's office in Beijing reports that China exports some \$2 billion of aquatic product a year to Japan. Other leading markets include the United States, South Korea, Hong Kong, and Germany, with totals ranging from \$1 billion to the United States to \$185 million to Germany. A recent U.N. Food and Agriculture Organization study projects that China's aquatic product consumption will rise by 80 percent over the next five years.²⁷

Water Shortages Spreading

Throughout the northern half of China water tables are falling, wells are going dry, and rivers are being drained dry before they reach the sea. The irrigation water prospect in the North China Plain, which produces half of China's wheat and a third of its corn, is one of the keys to China's long-term food security.²⁸

Farmers in this region rely on three rivers and two aquifers for irrigation water. The three rivers in the region, from north to south, are the Hai, Huang (Yellow), and Huai. The North China Plain has two aquifers, one shallow and one deep.²⁹

The Yellow River, the second largest river in China after the Yangtze, is often referred to as the cradle of Chinese civilization. Originating on the Tibetan Plateau, it flows through eight provinces en route to the sea. Unfortunately, in many recent years it has been drained dry, failing to reach the sea during the dry season.³⁰

The Hai river basin, the northernmost of the three, includes two of China's largest cities—Beijing and Tianjin, with 14 million and 11 million people, respectively. The whole basin, which contains 100 million people, is

now in chronic deficit. The Sandia National Laboratory, which has modeled the water balance in China's rivers, concluded that water withdrawals in the Hai River basin of 55 billion tons in 2000 exceeded the sustainable supply of 34 billion tons by 21 billion tons. This deficit is made up by groundwater mining. When the aquifer is depleted, the water supply in the basin will drop sharply.³¹

Urbanization is directly affecting the water balance in the Hai River basin. When villagers migrate to cities, where they have indoor plumbing, water consumption typically multiplies fourfold. Finding jobs in industry for the millions of new workers moving into the region imposes additional demands on the dwindling water supply. With competition for water between farmers, cities, and industry intensifying, irrigated agriculture in the Hai River basin may largely disappear by 2010.³²

Demands on Huai river water, the southernmost of the three rivers, comes from both Anhui and Jiangsu provinces. Like the other two rivers, it also is sometimes drained dry, failing to make it to the sea. Originating in the mountains to the immediate west of the North China Plain, the Huai is a key source of water for farmers in both Anhui and Jiangsu provinces.³³

The North China Plain depends heavily on two aquifers—a shallow aquifer that is replenishable and a deep fossil aquifer, which is not replenishable. Farmers, cities, and industries are pumping from both. Where the shallow aquifer has been depleted, the amount of water pumped is necessarily reduced to the amount that is recharged.³⁴

In many areas now, the deep aquifer is the principal source of water, but it too is being depleted. When this finally happens, pumping will come to an end. He Qingcheng, head of the groundwater monitoring team in the Geological Environmental Monitoring Institute,

observes that with depletion of the deep aquifer, the region is losing its last water reserve—its only safety cushion.³⁵

Water shortages will shape the evolution of China's economy in fundamental ways. The gravity of the water situation in the North China Plain can be seen in the frenzy of well drilling in recent years. At the end of 1996, the five provinces of the North China Plain—Heibei, Henan, Shandong, and the city provinces of Beijing and Tianjin—had 3.6 million wells, the bulk of them for irrigation. A detailed study of the situation in 1997 showed 99,900 wells abandoned as they ran dry. Partly to compensate, some 221,900 new wells were drilled. The desperate quest for water in China is evident as well drillers go to ever greater depths, often using technology borrowed from the oil drilling industry.³⁶

Concerns about the tightening water situation are reflected in a World Bank report: “Anecdotal evidence suggests that deep wells [drilled] around Beijing now have to reach 1,000 meters (more than half a mile) to tap fresh water, adding dramatically to the cost of supply.”³⁷

Turning Abroad for Grain

Each of the grains that together account for 96 percent of China's production—wheat, rice, and corn—is suffering a decline. Even with an improved wheat harvest in 2004, production still fell short of consumption by 12 million tons, an amount equal to the entire wheat harvest of Argentina. When the country's wheat stocks are depleted within the next year or so, the entire shortfall will have to be covered from imports. In some ways, the rice deficit is even more serious. Trying to cover an annual rice shortfall of 10 million tons in a world where annual rice exports total only 26 million tons could create chaos in the world rice economy. And with a corn shortfall of 12

million tons and stocks already largely depleted, China may soon be importing corn as well.³⁸

Before the 70-million-ton drop in China's grain production from 1998 to 2003, the country was producing a modest exportable surplus of 5–10 million tons a year. (See Figure 8–3.) Now this has changed. By 2003, grain production had fallen 56 million tons below consumption. With the harvest upturn in 2004, the shortfall improved but still stood at 35 million tons.³⁹

China has been covering its grain shortfall in recent years by drawing down its stocks. After peaking at 326 million tons in 1999, China's carryover stocks of grain plummeted to 102 million tons in 2004. (See Figure 8–4.) At this level, stocks amount to little more than pipeline supplies and cannot be drawn down much farther. This means that within another year or two shortfalls will have to be covered entirely by importing grain.⁴⁰

The decline in the grain harvest from 1998 to 2003 alarmed China's leaders. So did the rise in grain prices

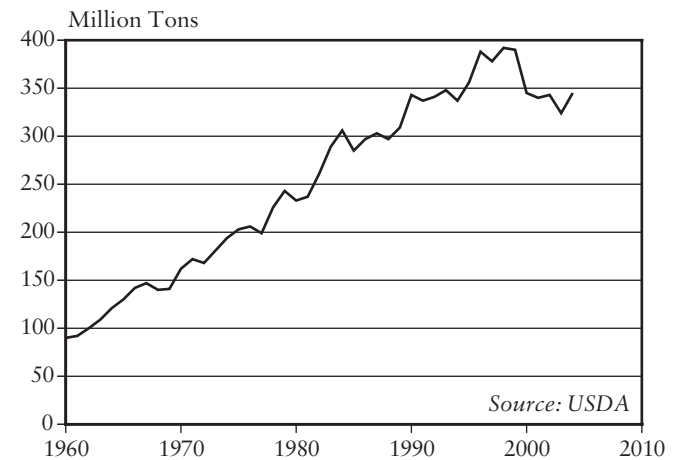


Figure 8–3. Grain Production in China, 1960–2004

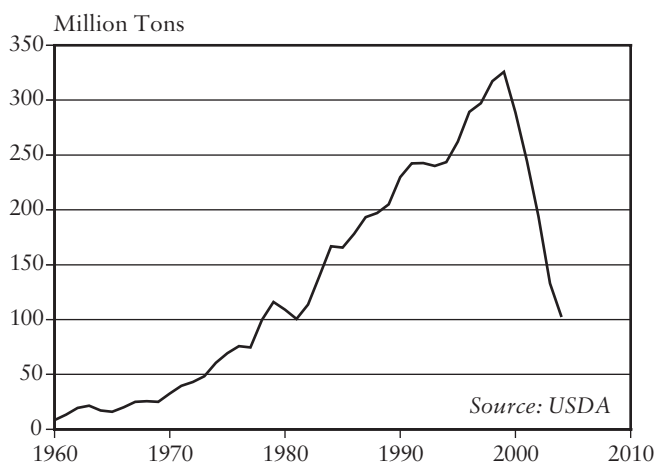


Figure 8-4. *Grain Stocks in China, 1960–2004*

beginning in the fall of 2003. The year-to-year rise of nearly 30 percent in grain prices between 2003 and 2004 forced the government to draw down its shrinking stocks of grain even faster in an effort to stabilize food prices.⁴¹

In late 2003 and early 2004, Chinese wheat-buying delegations purchased 8 million tons of wheat in Australia, the United States, and Canada. Within two years China went from being essentially self-sufficient to being the world's leading wheat importer. In March China made small purchases of rice from Thailand and Viet Nam for immediate import, suggesting that the internal rice situation, at least in some localities, was also beginning to tighten. In late August 2004, Beijing sought to buy 500,000 tons of rice from Hanoi, but was told that, given the export restrictions designed to ensure domestic rice price stability, Viet Nam could not deliver any rice until early 2005.⁴²

Concerned with falling production and the threat of

politically destabilizing rises in food prices, the government announced an emergency appropriation in March 2004—increasing its agricultural budget by 20 percent or roughly \$3.6 billion. The additional funds were to be used to raise support prices for wheat and rice, the principal food staples, and to improve irrigation infrastructure. For the State Council to approve such an increase outside the normal budgeting process indicates the government's mounting concern about food security. Nearly all the leaders in Beijing today are survivors of the great famine of 1959–61, when 30 million Chinese starved to death. For them, food security is not an abstraction.⁴³

On March 29, 2004, the government announced that the support price for the early rice crop would be raised by 21 percent. This got farmers' attention, as Beijing hoped it would, leading them to plant nearly 2 million additional hectares of rice—a gain of 7 percent from 2003. China's rice harvest rose from 112 million tons in 2003 to an estimated 126 million tons in 2004. This 14-million-ton gain was the result of both stronger incentives and a recovery from last year's weather-depressed yields. Overall, grain production was up 21 million tons in 2004. The much smaller gains for wheat and corn were, as with rice, due to a combination of better weather and stronger prices.⁴⁴

While stronger prices can temporarily reverse the decline in China's grain production, they do not eliminate the forces that are shrinking China's grainland area and thus its harvest. Unless Beijing can quickly adopt policies to protect its cropland, continued shrinkage of the grain harvest and mounting dependence on imported grain may be inevitable.

A sense of how quickly China can turn to the world market can be seen with soybeans. As recently as 1997, the nation was essentially self-sufficient in soybeans. (See

Figure 8–5.) In 2004, it imported 22 million tons—dwarfing the 5 million tons imported by Japan, formerly the world’s leading soybean importer. The Chinese economy is so large and so dynamic that its import needs can shake the entire world. Its soaring soybean needs, combined with a sub-par harvest in the United States in 2003, led to a temporary doubling of world soybean prices during the early months of 2004.⁴⁵

Over the longer term, China’s grain imports are likely to climb to levels never before seen. Japan, South Korea, and Taiwan today each import roughly 70 percent of their total grain supply. If China were to do the same, it would be importing 280 million tons per year. This exceeds current world grain imports by all countries of just over 200 million tons. This is obviously not going to happen, but what sort of adjustments will prevent China from following the path of Japan, South Korea, and Taiwan? What sort of economic stresses will develop in the

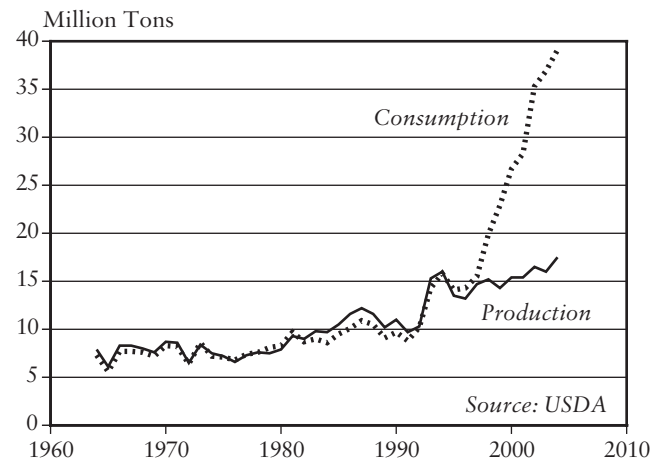


Figure 8–5. Soybean Production and Consumption in China, 1964–2004

world as China willingly or unwillingly is pushed in the same direction as the earlier Japan syndrome countries? What sort of stresses will develop within China if the world cannot supply the vast imports it needs?⁴⁶

A New Food Strategy

The freefall in China’s grain production from 1998 to 2003 indicates what can happen if Beijing continues with business-as-usual on the farm front. If China is to avoid a long-term decline in its grain harvest, it will need radical new policies and a basic reordering of priorities in the national budget. Future food security depends on policy shifts in land ownership, water pricing, desert reclamation, and transportation.⁴⁷

Following the economic reforms of 1978, the huge farm production teams were dissolved and the “Family Responsibility System” was introduced. Individual farm families were leased a plot of land for a 15-year term. When these began expiring in the 1990s, they were replaced with 30-year leases. For farmers, having their own plot of land to farm unleashed an enormous burst of energy in the countryside, one that boosted grain production from 199 million tons in 1977 to 306 million tons in 1984.⁴⁸

Unfortunately, even with these long-term leases farmers are still insecure because the land can be taken from them at any time by local officials. Arthur Kroeber writes in the *Financial Times* that China’s “village leaders can arbitrarily ‘readjust’ land rights at a moment’s notice, changing boundaries or even forcing farmers to move from an old plot to a new one.” They can also confiscate a farmer’s land and sell it for industrial development projects, compensating farmers at far below market value. There is no recourse because the farmers do not have title to the land. They are tenants, not owners. The authority of village leaders to appropriate land at will is

thus a threat hanging over the heads of villagers, a source of political control.⁴⁹

If tenants become owners, however, production might surge again. Giving farmers title to their land could harness latent energies in the countryside, encouraging them to invest in land improvements that yield long-term productivity gains, such as terracing and local water storage facilities. Taking this next step would help rejuvenate China's sagging agriculture, but it would also mean that local party officials would lose control of the land, and with it a large measure of political power.

Another key to reversing the decline in China's grain production is to accelerate its program to raise water productivity, particularly in the northern half of the country, where water shortages are strangling agriculture. This means pricing water at a level that reflects its value in a water-scarce situation. Higher prices combined with economic incentives to shift to more water-efficient technologies, whether in irrigation, in industry, or at the household level, can expand output while reducing water use to where water tables can be stabilized.

China also needs a reliable system of grain price supports that will encourage farmers to invest more in agriculture. They need not be particularly high, but they do need to be reliable. In 1994, when China raised support prices by 40 percent, it generated a strong production response, but then prices were permitted to gradually decline to the world market level over the next several years. With prices so low that farmers were no longer earning a profit, many of them simply lost interest and produced only enough grain for their own needs. Without reliable price supports that enable farmers to grow grain profitably, China's food security is at risk. The decision in early 2004 to raise the rice support price by 21 percent was a step in the right direction.⁵⁰

One of the innovative responses to China's growing demand for animal protein is the development of the world's most advanced aquacultural sector. At the heart of this effort is the highly efficient carp polyculture pioneered by the Chinese and described in Chapter 3, which enabled Chinese fish farmers to produce more than 15 million tons of freshwater fish in 2002. For China, this emphasis on the highly efficient production of animal protein is another positive step—and an example for other countries to follow.⁵¹

China, facing the growing competition between cars and crops for land, may soon be forced to reexamine its transportation policy. There is an inherent conflict between continuing to build an auto-centered transportation system and ensuring future food security. With nearly 1.2 billion of its 1.3 billion people living in less than half of the country on the eastern and southern coast, the competition between cars and farmers for land will be intense. If China moves toward having a car in every garage, American-style, it will face not only gridlock but soaring food shortfalls as well. If Beijing continues to expand the production and ownership of automobiles, cropland will almost certainly continue to shrink. The alternative is to develop a passenger transport system centered on high-tech rail and buses, augmented by bicycles. Such a system would provide not only more mobility in the end, but also greater food security.⁵²

In some ways the most intractable environmental problem China faces is the growth of deserts throughout the western and northern parts of the country largely as a result of overgrazing. Unless the central government makes a concerted effort to reduce the population of sheep and goats to the carrying capacity of the grazing lands, deserts will continue their eastward march toward Beijing and the blinding dust storms that mark the late

winter and early spring will become even more frequent.

Planting marginal cropland in trees helps correct the mistakes of overplowing, but it does not deal with the overgrazing issue. Arresting desertification may depend more on grass than trees—on both enabling existing grasses to recover and planting grass in denuded areas.

Beijing is trying to arrest the spread of deserts by asking pastoralists to reduce their flocks of sheep and goats by 40 percent, but in communities where wealth is measured in livestock numbers and where most families are living under the poverty line, such cuts are not easy. Some local governments are requiring stall-feeding of livestock with forage gathered by hand, hoping that confinement of herds will permit grasslands to recover.⁵³

China is taking some of the right steps to halt the advancing desert, but it has a long way to go to reduce livestock numbers to a sustainable level. At this point, there is not yet a plan in place that will halt the advancing deserts. Qu Geping, the farsighted Chairman of the Environment and Resources Committee of the National People's Congress, estimates that the remediation of land in the areas where it is technically feasible would cost \$28.3 billion. Halting the advancing deserts will thus require a massive commitment of financial and human resources, one that may force a choice between the large investments proposed for south-north water diversion projects and those required to halt the advancing deserts that are occupying more of China each year.⁵⁴

China is faced with an extraordinary challenge. Adopting the needed policies in agriculture, water, land ownership, desert reclamation, and transportation to ensure future food security will be far more demanding than for countries that developed earlier, when land and water were more plentiful. Stated otherwise, if China is to restore and sustain a rise in grain production, it will have

to adopt measures in land use planning, transportation, and water use that are responsive to its unique circumstances—measures that no government has ever adopted. The entire world has a stake in China's success.

Data for figures and additional information can be found at www.earth-policy.org/Books/Out/index.htm.