

Grain Area Expected To Decline

China is a relatively land-poor country but has 40 percent more arable land than is reported. Urban sprawl and infrastructure projects will take more land out of production than can be reclaimed. But increased intensity of land use will compensate for this loss so total sown area remains unchanged. Area sown to grains will decrease as farmers switch to more profitable crops such as fruits and vegetables.

According to official statistics, arable land area in China totals 95.3 million hectares, with 88 million hectares devoted to grain production in 1995 (USDA definition). While China's land area on a per capita basis is higher than its neighbors' (3.3 times more than Japan; 2.5 times more than South Korea; and 2.8 times more than Taiwan), compared with the United States, China is relatively land poor (fig. 18). Limited arable land and a large rural labor force mean that China will tend to have a comparative advantage in the production of labor-intensive (land-saving) crops such as fruits and vegetables and a disadvantage in the production of land-extensive crops such as grains and oilseeds.

There is controversy about the amount of arable land that actually exists in China today. A report published in 1992 notes that the actual amount of arable land more than 10 years ago was 44 percent greater than the 97 million hectares of arable land officially reported by China's State Statistical Bureau (SSB) (40 and 49) in that year (fig. 19). The 1997 census of agriculture in China will provide a basis for more reliable arable land estimates. China surely is losing arable land each year to urban development, road and rail construction, factory sites, dams, docks, bridges, and airfields. At the same time, new farmland is being reclaimed (49).

China's arable land in southern latitudes could be used more intensively year round. The ratio of sown area to cultivated area is currently 1.56, much higher than in Japan (1.03) and in Korea (1.14), and could be pushed higher to 1.6 by 2005.

From 1960 to the mid-1990's, the economies of Japan, Korea, and Taiwan grew very rapidly. Industrial growth boomed, infrastructural projects were constructed and agricultural economies were transformed. Rural laborers shifted from raising grain crops to raising other crops and livestock. These workers also

found employment in both rural and urban industries. On the basis of comparative advantage, these countries revamped their cropping patterns, decreased area sown to grain, and increased area sown to other crops—horticultural crops, flowers, fruits, and vegetables. Despite industrialization and the encroachment of factories, roads, railroad, docks, and airfields on agricultural land, the quantity of arable land declined only slightly (fig. 20).

As noted above, China is better endowed with arable land than its East Asian neighbors. Nonetheless, China likely will follow the central trend of its neighbors. Industrialization in the coming decades will not decrease China's stock of arable land very much. But total area sown to grains will fall because losses of arable land are expected to outpace reclamation. Some marginal land sown to grain crops will be returned to pasture and forest which will improve China's environmental land use balance. Farmers will switch some grain area to more profitable crops such as fruits and vegetables. Area sown to grain is expected to decrease from 87.4 million hectares in 1995 to 86.7 million hectares in 2005 (fig. 21).

Farmers are projected to reduce area sown to rice crops from 31 million hectares in 1995 to 28 million hectares in 2005. Wheat area is projected to remain roughly constant at about 29 million hectares through 2005.

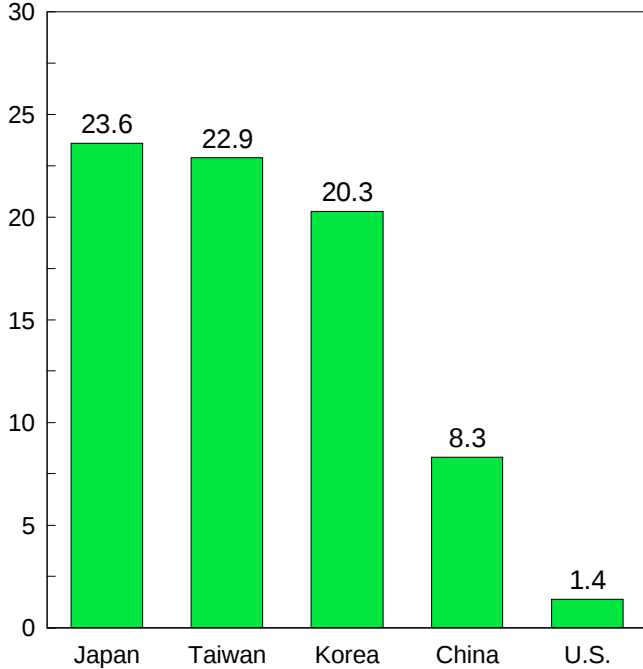
Demand for coarse grains (corn, sorghum, millet, barley, and oats) for feed use is expected to rise. Prices likely will rise, which will encourage farmers to expand from 28 million hectares in 1995 to 29 million in 2005, an annual increase rate of 0.2 percent. In 1994, the area sown to corn accounted for 80 percent of total coarse grain area. Corn area is projected to increase at 0.6 percent a year, faster than area for other coarse grains.

Figure 18

Persons per hectare of cultivated land

While China's land area on a per capita basis is higher than its neighbors; compared with the United States, China is relatively land poor.

Number



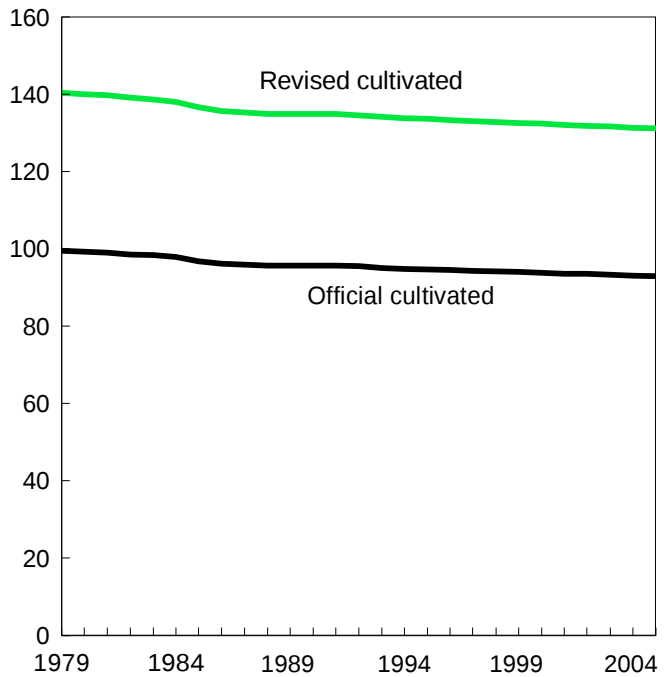
Source: (45).

Figure 19

Arable land in China

Amount of arable land in China is larger than reported.

Million hectares



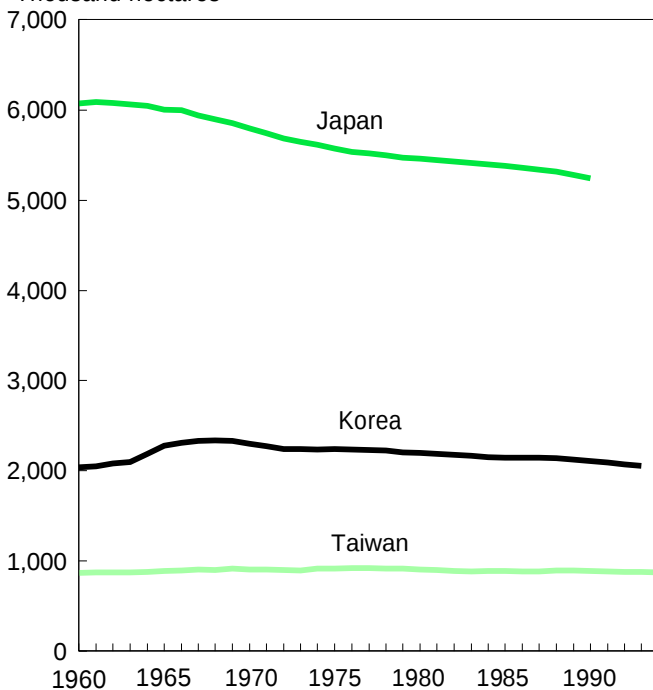
Sources: (40, 45, and 49).

Figure 20

Patterns of arable land use in East Asia

During rapid industrialization, arable land decreased slowly.

Thousand hectares



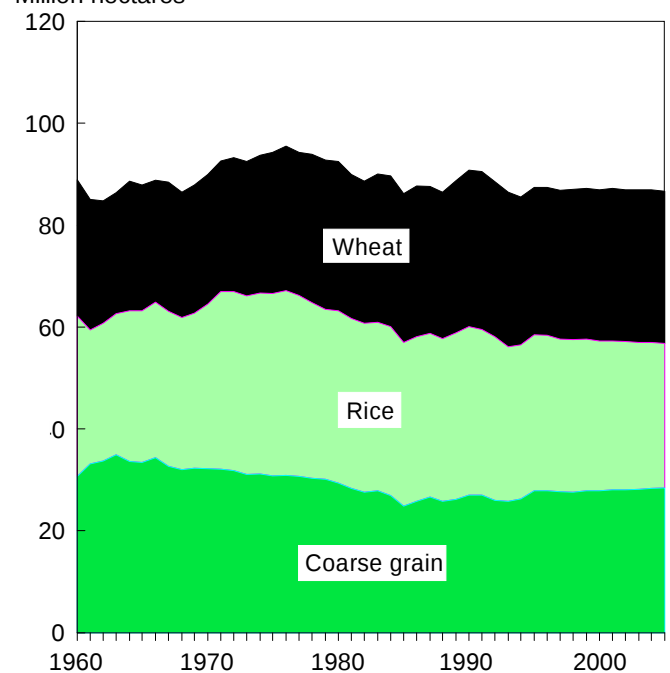
Source: (45).

Figure 21

Grain sown area projections

China's grain area to decline.

Million hectares



Sources: (44, 45, and 48)

China's Farmers Have Potential To Raise Yields

Underreporting of arable land has led to inflated grain yield estimates. With judicious investment in seed research, chemical fertilizer production, and water resources, grain yields can be increased.

While ERS does not provide an alternative set of grain area numbers to SSB data, it takes into account the implication of underreporting on the future growth potential of China's grain yields.

Underreporting of arable land in China has led to inflated estimates of grain yields and the appearance that China's yields are high by world standards. SSB statisticians have admitted that they have overstated grain yields to compensate for the underreported land area.¹ They rely on sample survey cuttings to determine actual yields, and then inflate them 20 to 30 percent.

Because of such underreporting, China's grain yields have ample room to increase above current levels (fig. 22). Higher yielding seeds, additional inputs (such as fertilizer and irrigation), and better pest management can help yields continue to rise.

Science and Technology

Government investment in agricultural research as a percent of total government expenditures dipped in the 1980's and early 1990's. In the ninth 5-year plan (1996-2000), however, government authorities have pledged to increase investment.

¹China's statistical officials focus most of their energy on estimating grain production. They know that cultivated area is underreported and adjust yields to more closely approximate actual grain production. Sample survey statistical workers adjust sample survey yields by using a verification coefficient (12).

$$\text{Verification coefficient} = \frac{\text{Verified area}}{\text{Farmer reported area}}$$

Cultivated land area data are controlled by local government authorities who have financial interest in land taxes and grain procurement quotas and not statistical officials. These tax and financial issues have put a strain on relations between central and local governments (local areas are better off financially if they pay less land taxes and show lower grain area so they won't have to sell more grain at low fixed quota prices). Authorities likely will not revise cultivated area data until the financial and tax issues are resolved (12 and 49).

Higher Yielding Seeds

China's leaders soon will be faced with three choices about higher yielding seeds: 1) increase investment to build up domestic seed-breeding capacity; 2) increase imports of high-yielding grain seeds; and 3) create a business environment in which domestic/foreign seed companies will invest in seed development. Hybrid corn and rice varieties currently account for about 80 and 50 percent of China's total corn and rice crop area, respectively. We assume that China's leaders will respond to seed development requirements and choose one or a combination of these options.

Fertilizer Use

Grain yields can be increased through fertilizer use in three ways. First, there is room to increase the quantity of fertilizers applied (fig. 23). Fertilizer usage remains low in many interior provinces. China's ninth 5-year plan calls for investment to expand and upgrade chemical fertilizer plants and the output target for 2000 is 28.4 million tons (nutrient weight basis)—up 16 percent.

Second, a less volatile form of nitrogen, like urea, can be used. Thirty percent of fertilizer applied in China now is ammonium bicarbonate, a volatile form of nitrogen, in which much of the nitrogen escapes into the atmosphere before it becomes available to crops.

Third, yields can be raised by applying a better mix of chemical fertilizers (N,P,K). On a nutrient weight basis, nitrogen (N) accounted for close to 75 percent of China's fertilizer production in 1994. Phosphorus (P) output has risen sharply in the last decade, but in 1994 it still accounted for only 23 percent of total output. Only small quantities of potassium (K) are produced (400,000 tons nutrient weight basis in 1994). In 1995, compound fertilizer imports surged dramatically, reaching a record 19.9 million tons (of which 4 million tons were potassium fertilizers—product weight basis). China plans to expand the production and use of phosphorus and potassium in compound fertilizers (fig. 24).

Water Resources

While central and south China have adequate water supplies, western and northern China have serious water deficits. The problem of water shortages in north China has been known for decades. Farmers expanded irrigated area in the North China Plain in the 1970's by drilling shallow tube wells and using pumps to provide irrigation water when summer rains failed to deliver the necessary moisture. Rainfall provides most of the moisture required for crops and farmers irrigate when rainfall is not timely. This added quantity of water and chemical fertilizer, however, enabled farmers to greatly boost grain yields in the 1970's and 1980's. We have assumed in our projection that water supplies in the North China Plain will hold out for the period under study—1996-2005.

Evidence of a falling water table in the North China Plain may spur government leaders to look for creative solutions. These could range from using concrete ditch liners for water conservation to charging water user fees as incentives for more efficient use of water resources. China has also considered diverting water from the Yangzi River to the North China Plain—a very large and expensive civil engineering project.

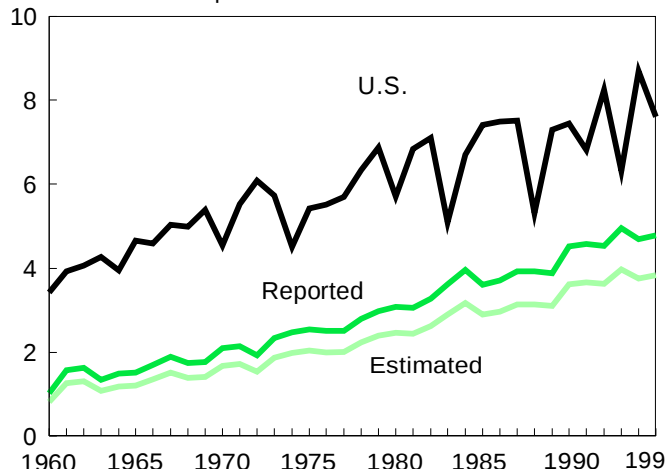
A separate but related problem—water quality—could be addressed by constructing sewage treatment facilities in rural and urban areas.

Figure 22

U.S. and China corn yields compared

China's grain yields have ample room to increase above current levels.

Million metric tons per hectare



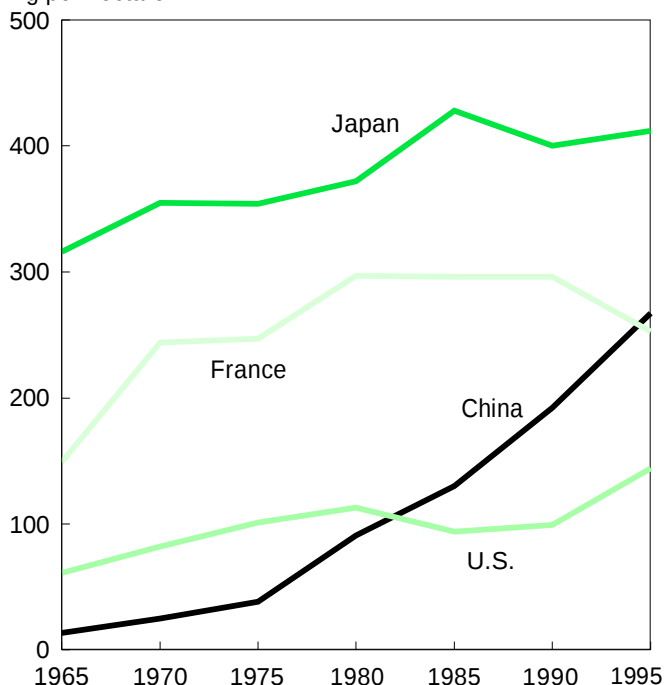
Source: (45).

Figure 23

China's fertilizer use

China's fertilizer use is below Japanese levels.

Kg per hectare



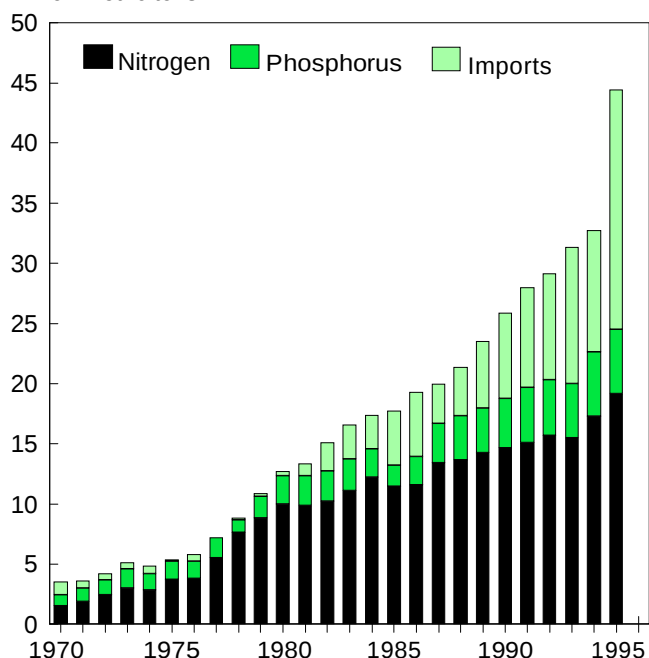
Sources: (40 and 46).

Figure 24

China's fertilizer production and imports

China's fertilizer production and imports have risen sharply from 1970.

Million metric tons



Source: (40). Imported fertilizers include nitrogen, potassium, and compound ones which contain N,P,K and other elements.

China's Grain Yields and Production Will Rise

Wheat, rice, and corn yields are projected to rise in the coming decade. These yield increases will compensate for the decrease in area sown to grain crops so that total grain output is projected to increase 1 percent a year.

Based on projected investments in seed development, increased and better balanced fertilizer use, improved pest control programs, and more efficient use of irrigation water, grain yields are projected to rise at an annual average growth rate of 1.3 percent over the next 10 years (fig. 25). ERS projects total grain production in China to increase 1 percent a year, from 346 million tons in 1995 to 382 million tons by 2005 (fig. 26). China is currently the world's biggest grain producer, accounting for 20 percent of the global total.

China's wheat yields are relatively high by world standards because a significant amount of wheat area can be irrigated if water shortages develop. These yields are projected to annually increase by 0.7 percent to 2005. Rapid economic growth rates, rising incomes and changes in consumer preferences for quality wheat products, a projected population growth of 100 million people, and a projected increase of 150 million people in urban areas (from about 350 million in 1995 to 500 million in 2005 for the coming decade) will boost domestic demand for grain above supply (fig. 28). China's domestic wheat output is projected to rise about 1 percent a year (99 million tons in 1996 to 108 million tons in 2005).

Rice yields in coastal provinces are already comparatively high by world standards but yields in interior provinces have substantial potential to increase. Use of high-yielding varieties will slow as farmers plant higher quality (but lower yielding) rice varieties. Overall, rice yields are projected to increase slowly over the next decade at an annual average rate of 0.7 percent. Because of the drop in area sown to rice, rice production is projected to decrease slightly from 127 million tons (milled) in 1996 to 126 million in 2005. China likely will follow the general pattern of rice consumption as her East Asian neighbors—as incomes rise per capita rice consumption will hold steady or decrease (fig. 27).

Coarse grain yields other than corn are projected to increase modestly in the coming decade. But there is considerable room for seed breeders to develop high-yielding corn varieties for specific localities and for

farmers to boost yields by applying better balanced chemical fertilizers (fig. 22). Corn yields are projected to rise by 1.7 percent per year (from 4.76 tons per hectare in 1996 to 5.55 tons in 2005). With projected increases in area sown to corn and yield increases, corn output is projected to rise on an average annual rate of 2.3 percent (from 108 million tons in 1996 to 133 million tons in 2005).

Assumptions Underlying USDA Projections

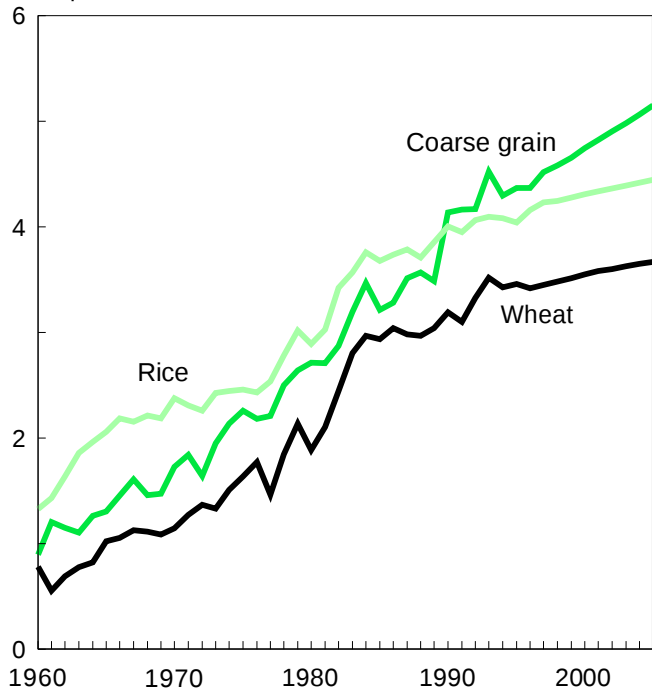
- Growth in grain yields depends on investment decisions and policy measures and commitment by the government. Low investment in agricultural research could lead to a slowdown in grain yield growth rates.
- The quantity of arable land at present is not certain. This will hopefully be resolved in the next few years after the 1997 census.
- Government intervention in grain markets and the fixing of procurement prices has an effect on grain production. These policies have been in flux, but we assume that current policies would continue, and that market forces would become increasingly important in decision making in the grain economy.
- A primary assumption made by USDA was that China's government would continue to control the imports of feed grains and meats. If this constraint is relaxed, grain and meat imports could be larger.
- USDA has been aware of the water shortages in the North China Plain for many decades. But for the period 1996 to 2005, we assume that water would be sufficient to allow for increases in grain output in that region of the country.
- USDA also assumes a stable political situation in China.

Figure 25

China's grain yield projections

China's grain yields to grow.

Tons per hectare



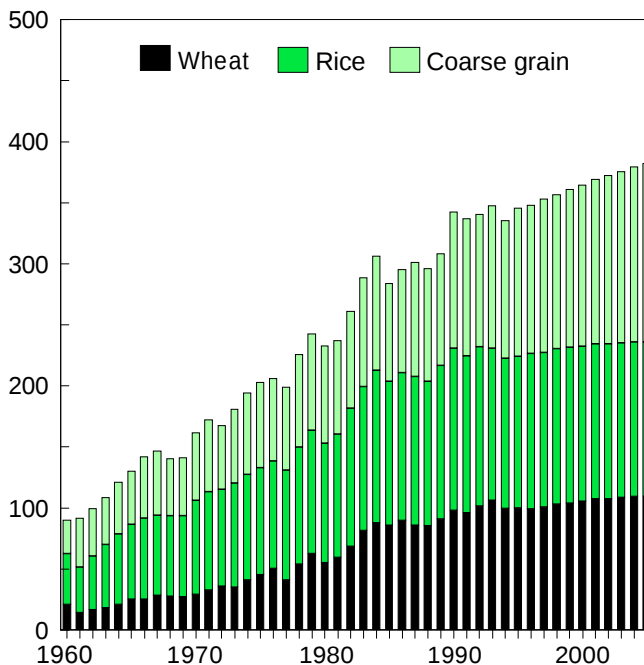
Sources: (45 and 48).

Figure 26

China's grain production projections

China's grain production is projected to rise 1 percent per year, 1996-2005.

Million metric tons



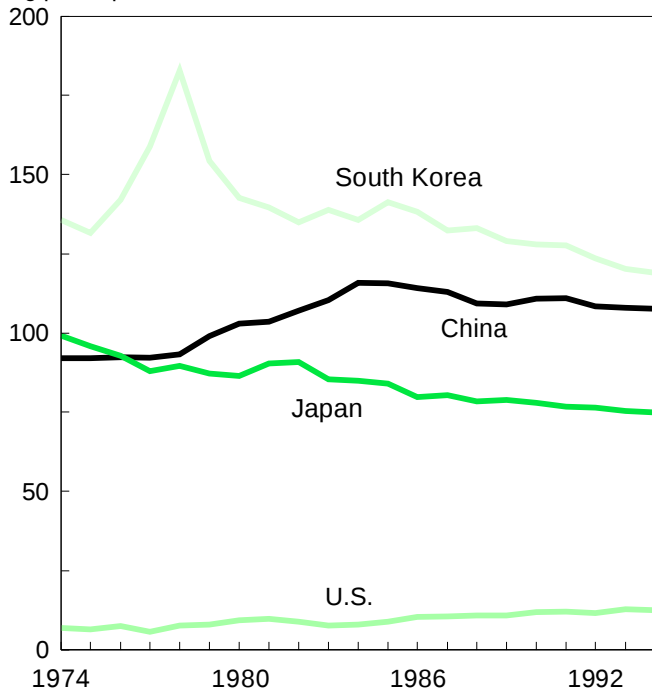
Sources: (45 and 48).

Figure 27

Per capita rice consumption comparison

Per capita rice consumption falling in South Korea, China, and Japan.

Kg per capita



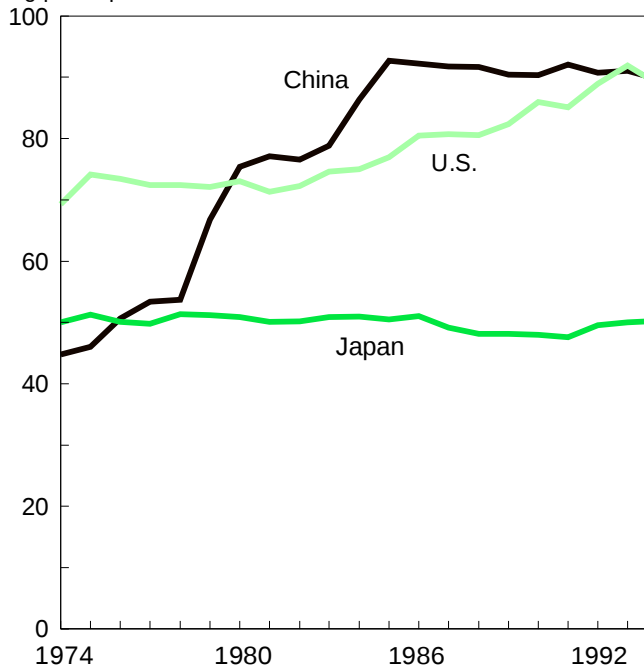
Sources: (45 and 48).

Figure 28

China's per capita nonfeed wheat consumption

China's per capita nonfeed wheat consumption parallels that for the United States.

Kg per capita



Sources: (45 and 47).

China's Imports Will Rise Steadily Despite Infrastructure Constraints

Investments in grain handling facilities in the past and coming decade will permit increased grain imports, which are projected to increase from 16 million tons in 1995 to 32 million by 2005.

Infrastructural Constraints to Grain Imports

Rapid economic growth since 1980 has put an enormous burden on China's ports and transportation systems (fig. 29). Over the coming decade, China will expand its overworked rail system and build a road system to link farms, factories, consumers, and ports. China has a large number of excellent seaports but much work will be required to expand the number and capacity of berths and improve efficiency of port operations (30) (fig. 30).

The World Bank estimates that China should invest \$300 billion in the coming decades to upgrade its transportation infrastructure. The World Bank currently has a \$490-million project to improve the grain-handling systems, elevators, and pneumatic loading, which will greatly aid China's grain imports. One should note that China's seaport cargo throughput more than tripled from 217 million tons in 1980 to 744 million tons in 1994 and by 2000 the target capacity will be 1 billion tons. Domestically, most grains are transported via highways and railroads (fig. 31). We assume that from 1995 to 2005 China's port, rail, and road infrastructure will improve to handle the additional forecasted 16.5 million tons of grain imports. Building new grain-handling facilities at China's ports will cost several billion dollars.

Steady Grain Importer

By most calculations, China will neither import huge volumes of grain nor return to being a large net exporter of grains as it was in 1992-93. Instead, it will gradually become a more significant importer of grains by 2005 and probably beyond. This forecast arises from the likelihood that demand for feed grains will accelerate faster than production increases, and that China's government policies will accommodate these changes. ERS projections are in line with forecasts made by a number of other institutions with the exception of one (fig. 1). Lester Brown of the Worldwatch Institute projects that by 2030 China will import 207 million tons assuming no change in livestock product

per capita consumption and decreasing grain output (5). If per capita livestock product increases, then he projects China will import 369 million tons by 2030.

There are mitigating factors that rule out such a large increase.

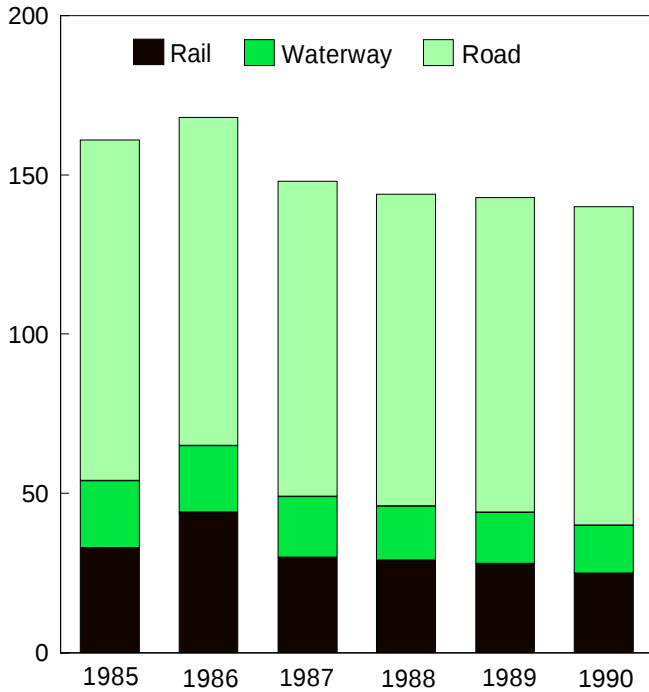
- Long-term projections need to take into account the self-correcting mechanisms in market economies. Grain shortages would lead to rising prices, stimulating production and reducing consumption, in China as in the rest of the world.
- China still can expand grain production. Because local authorities underreported cropland areas by an estimated 40 percent in the past, China's yield statistics have been overstated. The actual yields leave much room for future improvement through better management, higher yielding seeds, and greater use of inputs.
- Although China's meat demand will rise in the future, its growth will slow since it is already at a high level for a country at China's level of development. Per capita annual meat consumption (40 kg) is roughly on par with that of Korea (37 kg) and Japan (44 kg).
- Even supposing that China meets the requirements to become a member of the World Trade Organization, China's policymakers probably will restrain meat consumption, on the grounds of promoting domestic self-sufficiency and by claiming that meat is a luxury good (as in Korea and Japan). Such a policy would permit imports of feed grains but restrict imports of meats. This would keep meat prices inside China high and consumption relatively low.
- Limited grain handling capacity in China's ports will constrain the quantity of grain China can effectively import. Likewise limited container handling facilities and cold storage space will constrain the amount of chilled/frozen meat that can be imported.

Figure 29

China's freight handling capacity

China's capacity to handle freight increased.

Million metric tons



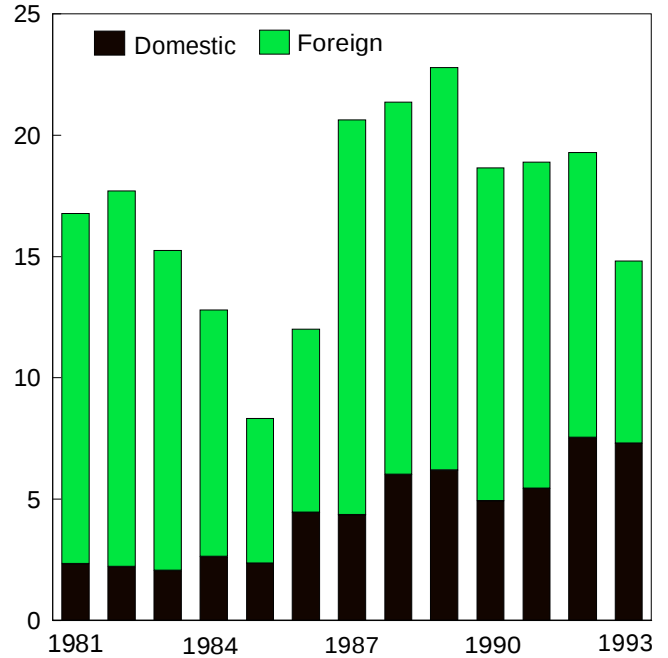
Source: (40)

Figure 30

Grain handled at China's ports

Coastal ports have handled large quantities of grain in past years.

Million metric tons

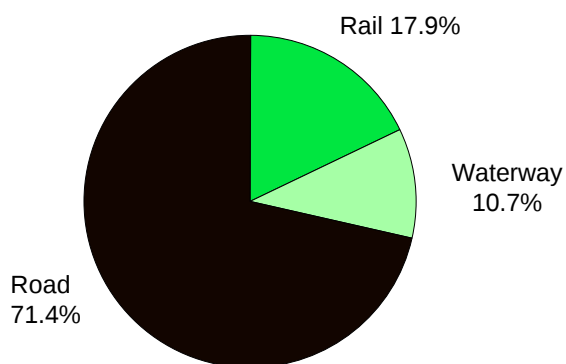


Source: (40)

Figure 31

China's grain distribution modes

Domestic grain transport is mainly by road and rail.



Source: (40)