

NPG Forum

China as an “Emerging” Nation

What It Means for the Rest of Us

by Lindsey Grant

China is not just an example of an industrializing nation. Alone, it is one fifth of the human race, and every nation has a stake in its future. The Chinese are cursed if they try to master their problems, damned if they don't, in trouble if they succeed and in worse trouble if they fail. And what is happening to China is happening, in varying degree, in other nations just now in the process of modernizing. Let me explain.

The Race Against Hunger

The Chinese have a massive population program underway epitomized in the slogan “the one child family.” Unlike most poor countries, they are financing most of it themselves. The program involves very intense social pressures not to become pregnant after the first child, and to abort if they do. There are various exceptions involving minorities, twins, peasant families with labor shortages. The program – like most campaigns in China – is not so totally effective as propaganda would suggest. (UN figures give total fertility – the average number of children a woman may be expected to have in her lifetime – in China right now as 1.95 children.) The program has been bitterly criticized abroad, particularly in the U.S., for coercion. It has in fact had its excesses, as have many of the campaigns launched in China.¹ Yet they cannot afford to give it up.

Let's look at their problem.

China's population is 1.22 billion, growing just over one percent per year. The rate of growth is about like the U.S., but in China that works out to more than 12 million people. Every year

Every growing population is on an agricultural treadmill, but China is the ultimate example. No supplier on Earth could feed them if they fail.

Traditional agriculture in China could achieve food yields sufficient to support as many as seven persons per hectare of arable land, on a simple vege-

table diet, but that was in only a few favored areas, under ideal conditions, and with massive human labor, legume rotations and the recycling of manure and nightsoil.

Now the population per hectare is 13 persons, and rising.² And those people have gotten used to having a little meat, rather than living at or below the margin, as they used to, on a grain diet supplemented by a few vegetables and some vegetable oil. How did they do it?

The Nitrogen Fix

A Canadian professor named Vaclav Smil asks a fascinating question: What was the most important invention in the twentieth century? His unlikely answer: the Haber-Bosch process of synthesizing ammonia and therefore nitrogen, introduced in 1913.

Nitrogen, Smil pointed out, is essential to chlorophyll, DNA, RNA, proteins and enzymes – in short, to life itself. There are only three natural atmospheric processes for converting atmospheric nitrogen, which is locked up in N₂ molecules, into a form usable by plants and animals: falling meteors, ozonization and ionization by lightning. The only biotic process is the creation of ammonia by various bacteria, most notably by the rhizobium bacteria that live symbiotically on the roots of legumes (such as peas and beans.)

Nitrogen and water are the two most important limiting factors in plant growth. Until the Haber-Bosch process, humankind could obtain nitrogen only by green manuring with legumes and recycling nitrogen by spreading animal manure, guano from seabird rookeries, and nightsoil.

Yields per hectare are the critical issue in China. By and large, the land that can be farmed is being farmed, as is some that should not be farmed. Arable land is shrinking because of urban sprawl, industrialization, salination of fields, and desertification.

The official figures show a decline of six percent in arable land from 1970-1991 and a loss in 1992 to urbanization alone at the rate of nearly 5 percent per decade.³ Those losses are particularly significant, since the land closest to cities gets the most nightsoil and is highly productive. Moreover the amount of land *per capita* declines with population growth. Food yields must more than match population growth just to stay in place.

That is where synthetic ammonia comes in. Its invention permitted agriculture to support an unprecedented population. By Smil's calculations, synthetic fertilizers now provide the nitrogen for about half the annual global crop harvest. To phrase the point more starkly: perhaps one-third of the people in the more crowded and land-poor third world countries would starve, were it not for synthetic fertilizer. Moreover "virtually all protein needed for the growth of more than 400 million babies to be added in the eight populous but land scarce countries during the 1990s will have to come from synthetic nitrogen."⁴ (China, of course, is one of the eight countries.) China escaped from subsistence agriculture by building fertilizer plants, starting in the mid-1950s. It has about reached the end of that road. China uses nearly three times as much fertilizer per hectare as the United States, but grain yields are only 87% as high, probably because they must farm poorer land in drier areas, and they have less experience with modern high yield hybrids and crop varieties. In some areas of heaviest application, the response to further fertilization in China is zero.

Those are the limits that every nation encounters when it goes in for massive use of artificial fertilizer. China's situation is particularly tight, because it has so little arable land. It cannot go back to organic agriculture, with its much lower average yields. Smil points out that synthetic fertilizer furnishes roughly half the nitrogen in Chinese food production, and even if China reverted to subsistence consumption levels it would furnish 40 percent of the essential nitrogen. Despite its harmful environmental effects, it is essential. Without it, China would face mass starvation. Moreover since China has long farmed substantially all its arable land and is using the available sources of organic nitrogen, any future increase in Chinese population will depend largely upon synthetic nitrogen, at a stage when the additional nitrogen produces very little food.

To add to its woes, China is losing topsoil to erosion. A Chinese official told an environmental meeting in Hong Kong that one-third of arable acreage is seriously affected.

Irrigation is pushing its limits. For one example:

some 622 km. of the Yellow River went dry for nearly four months in the summer of 1995. It was a dry year, but the phenomenon was blamed in part on a nine-fold increase in irrigation from the river since 1950.⁵ Around Beijing, irrigation is being reduced to meet urban water needs.

Every growing population is on an agricultural treadmill, but China is the ultimate example. It is in a race against time; they know they must solve their own problems. No supplier on Earth could feed them if they fail. Their birth control program must succeed, or they face a descent into starvation.

Those who criticize Chinese family planning policies should perhaps consider their problem. As the Chinese Premier bluntly told ex-President Bush: "If China's population goes on increasing uncontrolled... China will land in a backward state and even head for self-destruction."⁶

China as Importer

China is entering the world grain market on a massive scale just at the time when stagnating yields and competition from other emerging countries are making that market very tight.

In the bad old days, China could not afford imported grain. If the crops failed, people starved. Then, as commercial fertilizers became available and food output rose, China briefly became a food exporter. That has changed again, and China now runs a net annual grain deficit around fifteen million tons, second only to Japan. As a result of their relaxation of controls and their economic boom, they can afford to buy grain. They need to for domestic reasons. The price of grain rose 60 percent in 1994. That is the kind of thing that leads to food riots.

There has been something of an international intellectual skirmish as to how much grain China will need a generation hence, and where it will get it. The Worldwatch Institute projects a requirement for 479 million tons by 2030, of which 207 million tons would have to be imported, even if improvements in the Chinese diet should stop now. If the diet continues to improve to something like the level in Taiwan, Worldwatch projects the need at 641 million tons, 369 million tons of which would have to be imported.⁷ That is nearly twice the present level of total world grain exports.

China's Agriculture Minister responded with an ambitious goal of avoiding imports by raising grain production to 500 million tons in 2000 and 625-675 million tons in 2020—about 45 percent above current production. As the cynical would say: lots of luck.

Other specialists, Chinese and foreign, offer a wide range of production projections and estimates of

import requirements early in the next century ranging from zero to 136 million tons per year⁸ Nobody really knows, but nobody is claiming they will again be exporters.

One does not need to take the astonishing Worldwatch Institute projections literally in order to agree with the thrust. They assumed a decline of 20 percent in Chinese grain production as a result mostly of declining acreage and irrigation and stagnating yields. That may be pessimistic, but the Minister of Agriculture is extremely optimistic.

Chinese imports will depend on how much they can afford – how much foreign exchange they can muster and what the price will be. I read the Worldwatch message as saying, not that they will buy that much, but that they will not be able to, because the world's importers will be competing bitterly for a limited supply

If they cannot raise the grain or import it, the Chinese government will have to tell the Chinese to tighten their belts. A lot of peasants may be reluctant to part with their grain and insistent on sharing in the benefits of a rising market for what they do sell. A very tough spot for government, and one that leads me to repeat the refrain: China's problems should not be worsened by rising population driven demand.

If China had succeeded by now in its hope of reversing population growth, the specter raised by the Worldwatch projections would disappear. Population growth is the problem on both sides of the calculation. It raises demand, while it competes for farmland and demands more and more water from limited resources for irrigation, more housing, larger cities, and expanding industries.

A less desperate parallel arises in connection with petroleum. One expert predicts that China's petroleum imports will rise fourfold to 1.4 million barrels per day by 2005.⁹ Imports at that scale would absorb about 5% of current world exports and would be competing with rising demand from other emerging countries. It would hasten the energy transition for the whole world. On the other hand, if it cannot buy the petroleum, China will intensify its use of coal – the "dirtiest" fuel – and nuclear power, the most dangerous. These both have profound environmental consequences for China and the world. Damned if they do, damned if they don't.

Industry and the Peasants

There are at least two Chinas. Not just the familiar China vs. Taiwan division, but the far more fundamental fission line between the prospering southern coastal cities and the peasantry, particularly in China's vast interior. Only a small part of China is

participating in the present economic boom. The peasants know that some Chinese are getting rich, while they have financed the cities through grain levies and taxes. There have been riots and attacks on local government offices. It is not comfortable out there in the countryside.

That division has far reaching implications. A restless and growing peasantry is in danger of losing the gains of the past thirty years, and the loss of expectations is a dangerous mood indeed. They are running out of farmland and crowding into overloaded cities, encountering a small business plutocracy some prospering entrepreneurs and a small group of skilled workers who are "in the system."

The Ninth Five Year Plan (1996-2000) addresses the problem with considerable candor. Rural and urban unemployment and the "polarization of rich and poor" are identified as critical problems. One drafter, in presenting the draft plan, said "Unemployment was the deciding factor in setting the growth rate... the only way to keep unrest from boiling over... is to create a certain number of jobs."¹⁰

The official figures on unemployment are indeed hair-raising. Aside from the cities, there are reported to be 450 million people in the rural work force, of whom 120 million are employed in rural industrial enterprises. Agriculture can use 200 million at most, leaving 100-200 million already surplus workers in rural areas by various officials' estimates. By 2000, the number is expected to be somewhere between 180 to 300 million.¹¹ Look at those figures again. The rural unemployed alone may equal the total population of any other country in the world, other than India.

To cap that, the government hopes to modernize farming along Western lines and proposes over time to shift 80 percent of farm labor into other work.

The total labor force grows about 10 million every year. The cities also generate substantial unemployment as the government tries to reduce the padded rolls of state enterprises.

This nightmare drives wages toward minimal subsistence levels. Quite reasonably the poor want out. Witness the desperate efforts by Chinese to get to the U.S. even in the midst of a touted economic boom – and most of those boat people come from a coastal province that is supposed to be prospering. There is even a governmental "overseas employment agency" in one depressed Northeastern city to help Chinese to emigrate.¹²

Because China's family planning program has succeeded pretty well, there is hope down the road. The number of young people entering their working years is already below the 1985 figure. It will fluctuate

ate downward if China can hold its fertility down,¹³ thus ameliorating the unemployment problem.

Industry and the Environment

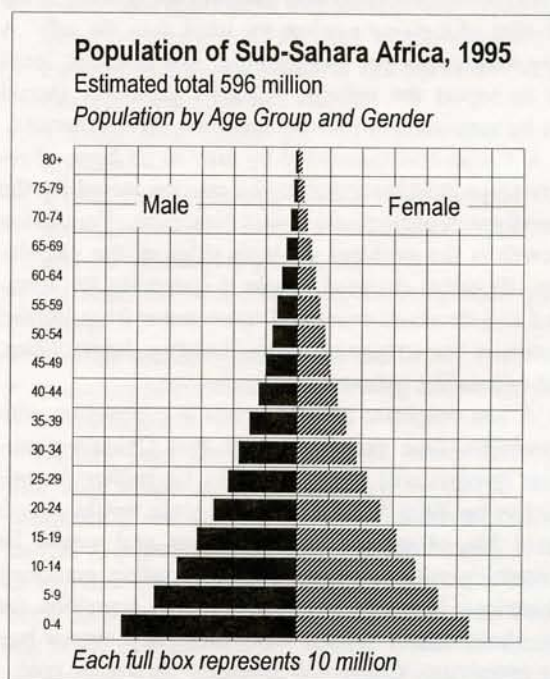
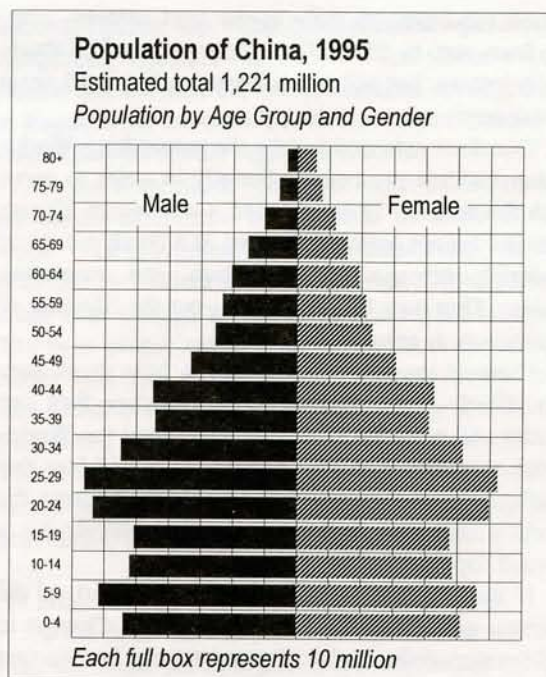
Like most other people, the Chinese do not simply want to stay alive. They want to succeed, and the economic liberalization that Deng Xiaoping launched has created a class of people for whom that dream has become possible.

China epitomizes some uncomfortable realities. The poor want to be rich; poor nations want to live like us.

China is one of the world's fastest growing economies. GNP grew from 1991-1994 at an average annual rate of 11.7 percent. They plan a "more balanced" growth of 9.3 percent through 2000, and 8 percent from 2001-2010. That would mean a seven-fold increase in 25 years. They hope to reach the per capita GNP level of a "middle income developed country" by mid-century.¹⁴ They are talking of the median of OECD countries. Allowing for projected Chinese population growth (UN 1994 medium projection), they are aiming at a total GNP more than 70 times as large as in 1990 – even assuming the OECD level stands still.

They are not likely to get there, but in the process of trying they will generate some profound disturbances to themselves and the world. Their problem is that, having abandoned the Communist model (in fact if not in word), they have adopted the capitalistic model – conspicuous consumption and all – just as it begins to run against the realities of a small Earth. China produced 10,000 automobiles in 1985 and 1.4 million in 1994. It hopes to treble that rate by 2010. By then, they expect to have 40-50 million private automobiles.¹⁵ They could hardly have selected a worse way to go. Automobiles eat up land for roads and parking and the urban layouts they promote, and much of that land will come out of China's dwindling farmland. Their pollution may harm farm production. It will contribute carbon to global warming, which would be a disaster for low-lying coastal areas and would imperil food production if it leads to less rainfall in a hinterland already suffering from lack of water. Their demand for gasoline will eat up foreign exchange that the Chinese will need, to import food.

In retrospect, it may seem a tragedy that the Chinese leaders, given the chance, did not set out to define a more benign course of modernization when they abandoned the Maoist rigidities. One could envisage a China built upon freer enterprise and the price mechanism, but organized around the countryside and smaller cities, emphasizing labor-intensive



There is a lesson here for other third world countries. That sudden tuck in the bottom of the Chinese pyramid, compared with the flaring African pyramid, means fewer children to support now, an eventual reduction in the huge number of unemployed, fewer mothers having babies in the next generation, and the hope for stopping runaway population growth. The comparison with Africa's plight is a dramatic argument for population programs. (UN 1994 Medium Projections)

occupations and avoiding the energy intensive Western industrial models. Apparently the leaders did not see the vision or did not feel they had the choice. Chinese want the things they see on television, and TV now reaches most villages. If their government fails in its ambitious plans, it will face a restive populace. If it succeeds, they may well choke themselves, and us.

As with other nations that have been poor, China's leadership does not yet appreciate the penalties that growth will bring. Already 86 percent of rivers in urban areas are regarded as heavily polluted. Shanghai alone dumps five million cubic meters of raw sewage into its rivers daily.¹⁶ Unwashed coal provides most of China's energy. The air is foul. Entrepreneurs are even setting up "oxygen kiosks" in some cities, where people can stop for a whiff of pure oxygen. Despite some help from the World Bank and the Asian Development Bank, Chinese environmental leaders themselves say that they cannot afford to do all that needs to be done.

China alone will not suffer. Already, acid precipitation from China is affecting western Japan. China has every intention of using its coal, and coal is the dirtiest fuel in terms of acid precipitation and the greenhouse effect. There are technologies that could help to lessen the damage. In the United States, we demand that power plants use limestone slurry scrubbers to lessen the pollution. We have developed coal gasification processes that would be competitive if oil were not so cheap. They capture most of the pollutants other than CO₂.

The world has a stake in helping China avoid inflicting irreparable damage on the atmosphere. It could make those technologies available on concessional terms, if China could be persuaded to use them. There are limits, however. In China most coal is used in small home stoves that are particularly dirty. They can be improved, perhaps by adding limestone to the coal briquettes they burn, but they will remain a dirty source of energy.¹⁷

China as Exporter

The immense and under-utilized pool of cheap and trainable labor will keep Chinese wages low. If Chinese labor is organized, whether by Chinese entrepreneurs or multinational corporations, and if they can get their goods into foreign markets, they will drive wages down in labor-intensive industries wherever they have unrestricted entry. If they are closed out, the Chinese government will be sitting on that immense powder keg of people with nothing to do.

The United States has been providing that market, which has grown from \$1 billion in 1980 to \$39 bil-

lion in 1994. The U.S. China trade deficit is second only to that with Japan. The U.S. will probably begin to recover the deficit as China's grain needs rise, but as the imports soar there may be rising pressure to limit that access to the American market.

The Chinese need us much more than we need them, as a market and a source of food. As the proud heirs of "The Central Kingdom" they undoubtedly resent it. This makes our politicians' moralizing to them about personal freedoms and their population policy particularly galling. They pretty much have to take it, but our politicians are building a tremendous tension of suppressed resentment. It is remarkable how insensitive nations can be to each other's needs.

However that may be, the central trade issue is that China needs trade opportunities that the rest of the world, in attempting to save its own economies, may not be able to provide. Again, as with so many other things, population plays a central role. The Chinese are trying to work their way out of the box created by a growing labor force, and the graph suggests they have a chance. Let us not make it more difficult.

The Nervous Giant

China may seem huge and invulnerable from the outside, but it is a nation trying to survive on very treacherous ground. The question is regularly asked: "what will China do with Hong Kong when it takes over in 1997?" Perhaps a more important question is what Hong Kong will do to China. The Chinese leaders don't trust democracy. For a century they have tried to accommodate their ways of managing a huge nation to the needs of modernism. Confucianism was their traditional political framework, and it didn't work. The experience of the Soviet Union and Eastern Europe has made clear to them that statism doesn't work. Communism as a belief and unifying force has eroded in China just as it did in the rest of the Communist world.

China traditionally has broken apart when strong central government failed. Its leaders are intensely aware of that tradition. With the gradual passage of Deng Xiaoping from the scene, the succession issue is at the forefront of Chinese politics. Communism does not provide a reliable way to manage successions. This is a critical time for China, and today's policies are not perpetual. One issue may become crucial: the one child policy was not introduced because the Chinese like it. The leaders knew they had to stop population growth, even at considerable political risk, to avoid future catastrophe. In the present power struggle, will they be able to stick to that policy or will one or another leader, courting popu-

larity, propose to revoke it? Or will it simply become unenforceable if central authority weakens? Population policy has shifted before in the political seesaw since the idea of family planning was first introduced in the mid-1950s. There are ominous reports of rising resistance in the countryside to the population program.

We should perhaps consider that context when we evaluate the violent Chinese reaction when Hong Kong Governor Patten began to introduce direct elections into Hong Kong, just two years before its 1997 reversion to China. The Chinese were not just throwing their weight around. Patten was introducing a democratic precedent that the incorporation of Hong Kong into China will inject into the body politic, and the Chinese leaders are probably terrified at the injection.

China faces an uncertain future. Some people perhaps would like to see it fail. I disagree. Aside from the human aspect – which is important – one can hardly be comfortable with the prospect of chaos and hunger in that much of the human race, in a major military power quite capable of producing modern armaments including atomic weaponry.

On the other hand, if China succeeds, it will tighten an already tight world grain supply, hasten the end of the petroleum era and multiply the insults the human race is already inflicting on the environment. Environmentalism has been low among China's priorities, and it will take some tolerance and understanding to bring them to agree that they share our interest in protecting the environment.

Migration

Fail or succeed, China will probably generate migration. If they fail, there will again be hunger in China, and that raises the prospect of hungry Chinese pushing into any area where they can find land and food – not on a scale that would make much difference to China, but it would affect the neighbors. The Chinese have not traditionally been thought of as a nation of migrants, but that is a simplification. They have been pushing and drifting southward for over two thousand years. With a very few exceptions, they have not mounted invasions when they encountered a sufficiently organized non-Chinese society, such as the Thai or Vietnamese, but the informal flow of migrants into Southeast Asia continued. There are something like 30 million "overseas Chinese" in that region now. One may assume that chaos in China would revive that flow. There is a similar flow across the border into Siberia, even though the Chinese and Russian governments have an agreement to control it. The Russian Defense Minister has told the

Russian Cabinet that "Chinese citizens are peacefully conquering Russia's Far East." The Cabinet concluded that some of the ethnic Russians coming back to Russia from the erstwhile Soviet empire should be resettled in the border region as a buffer.¹⁸

On the other hand, economic success will provide the funds to finance boat people to more distant lands. The movement has quite a tradition, starting with the movement of Chinese from China's south coast near Canton to America in the 19th Century. The boat people recently apprehended in the United States said they paid \$10,000 or more for the trip. One needs relatives with enough money to bankroll that sort of movement, and candidates to undertake it. The combination of economic growth with widespread unemployment is precisely the matrix to support such a flow.

What Is At Stake?

What does that all mean for the rest of us? We may see China becoming several things at once:

- a new and aggressive exporter of low tech, high labor content goods, utilizing a vast pool of disciplined and trainable labor, and by their competition depressing world wages,
- a major new bidder on world food and energy markets,
- a desperately polluted coastal zone, adding substantially to the world's atmospheric pollution and contributing to global warming,
- an impoverished, hungry and unemployed peasantry,
- a rising source of migration, and
- a region of instability comprising about one-fifth of humankind.

Where does the logic of these trends force us? The only single solution that cuts across all those problems is the one the Chinese are already trying: an end to population growth. We have every reason to applaud and support China's desperate efforts to bring its population under control, rather than engaging in the constant warfare against it that has marked American, and particularly Republican, policy for more than a decade. Our criticism reflects domestic politics. We pay a high price for our fixation with the abortion issue. There are few if any moral principles as absolute and over-riding as their more fervent adherents believe.

We have an investment in their population program, and an interest in helping them to find the most benign possible ways of modernizing. If they fail, they may add less stress to the world's ecosystem, but the government will answer to a billion very unhappy people, and China could become a

dangerous loose cannon on the world scene.

If only from the standpoint of diminishing the flow of illegal immigrants, the United States has an interest in Chinese success in stopping their population growth.

Those "Other Chinas"

Add Brazil, India, Indonesia, Mexico, perhaps Pakistan, the Philippines and Thailand, plus the smaller "emerging market economies" to China. Their economies are growing, their needs are multiplied by population growth, and they will be low wage competitors on world markets.

Although the most successful emerging countries are also generally the ones with lower fertility they will continue to grow. Those eight countries alone will have three times the population by 2020 that the developed world has today. Development pollutes. Their development will almost certainly precipitate the huge resource and environmental problems that are just now surfacing.

The UN "Brundtland Commission" in 1987 concluded that, in equity we must anticipate a five or ten-fold growth in world industrial output to accommodate the modernization of the less developed countries.¹⁹ I believe that statement epitomizes the problem of trying to relieve poverty for a growing world population. It is inconceivable to me that, even with best efforts at pollution control and conservation strategies, such a growth would be environmentally tolerable, and there is yet no sign that the emerging countries will make those efforts. To take the greenhouse effect as an example: the developed countries are trying unsuccessfully to hold CO₂ emissions at the 1990 level, the developing countries won't commit themselves, and a five or ten-fold increase in such emissions would blow apart the present calculations as to the rate of global warming.

The newly prosperous countries will be competing for food, in a world market that cannot accommodate them. The established industrial regions, other than Japan, are net exporters of grain, but the newly emerging nations are major and growing importers. Asia, Africa and Latin America were roughly self-sufficient in 1950. They have now passed an annual grain deficit of more than 100 million tons. The Worldwatch Institute examined ten of the major food importers aside from China and concluded that their grain import needs will rise from 32 million tons in 1990 to 190 million tons in 2030. The world's exporters, led by the United States, are most unlikely to be able to double or treble exports to meet the prospective demand from the developing countries that can afford it. The poorest countries

such as most of sub-Saharan Africa and Bangladesh will be frozen out of the market. They have been getting food aid from the United States and Western Europe. Grain surpluses are declining; the FAO expects the 1996 carryover of stocks to be the smallest, in terms of days' supply since it has kept records. Experts warn that a crop failure in a major nation would be catastrophic. Grain prices are rising. In those circumstances, food aid is drying up despite pleas from the FAO. Even without a production crisis, the poor countries face their own threats of starvation.

Food is connected with population in a particularly inelastic way. Most countries have a stake in stopping population growth, to enable them to avoid or work their way out of the looming food crisis.

Food is connected with population in a particularly inelastic way.

American grain traders are celebrating the tightening market, and so perhaps are those who watch our balance of payments, but as a nation we will not gain from the prospect of a world grain shortage. At some point, not very far away the emerging industrial nations particularly in Asia will not be able to afford the growth pattern on which they have embarked, or they will be increasingly divided, like China, between the rich and the hungry. Desperation in the poor countries will rise. One can hardly predict how those conflicts will play out, but the prospect is for a less and less stable world until it is brought into a better balance. And that balance begins with the end of population growth and the accompanying explosion of demand.

What should the United States be doing? Our support for population programs in the developing world has been less than 5 percent of our foreign aid, and even that figure represents a doubling of foreign population aid in the current administration. The present Congress is determined to shrink foreign aid or – if Senator Helms had his way – eliminate it, and population aid gets a reduced share of the 1996 aid budget. We are heading exactly the wrong way. Assistance to foreign governments in addressing their population problems should be the first priority for American aid and a major element of our foreign policy.



Endnotes

1 The worst excess apparently is that of over-zealous local officials forcing late-term abortions on women in order to stay within quotas. The recent report by Human Rights Watch (AP Beijing, 1-6-96) of orphanages starving the children probably reflects official loss of control over expanding corruption. Pilfering from food budgets has a long history in penal institutions and orphanages, worldwide. China probably has not deliberately extended its demographic policies to raise mortality. There is a suspiciously high proportion of males in the official birth statistics, suggesting some female infanticide and/or parents' failure to report the birth of girl children in order to try again for a boy. However, child mortality is extremely low in China by comparison with other countries with similar per capita income.

2 Official Chinese statistics are frequently in conflict, underlying the danger of too close a reliance upon detailed data. The official Xinhua News Agency quotes the State Land Administration. "China has 120 million hectares of cropland, not just 100 million hectares as long reported." The Ministry of Agriculture refused to comment. (Reuter, Beijing, 3-10-95). The larger figure is credible, since peasants, local and provincial governments all have reason to understate acreage to avoid forced deliveries of grain to the center. A 25 percent discrepancy suggests that inferred fertilizer use and crop yields per hectare are substantially less than the official figures. Perhaps China has a bit more room for improvement than official data suggest.

3 USDA data and Reuter, Beijing, 8-29-94, quoting the Director General of the State Land Administration.

4 Most of the discussion in this section is drawn from Vaclav Smil, "Population Growth and Nitrogen: An Exploration of a Critical Existential Link" *Population and Development Review*, December 1991, pp.569-601

5 Reuter, Beijing, 7-19-95.

6 AP Beijing, 9-11-95, quoting the Xinhua News Agency

7 Data, including 1994 price change, and projections are from Lester R. Brown, *Who Will Feed China?* (New York: W W Norton, 1995) pp.96-97

8 Reuter, Beijing, 3-5-95 and 8-3-95, quoting Xinhua News Agency and experts from the Chinese Academy of Social Sciences and Academy of Agricultural Sciences, who estimated the shortfall at 50 million tons. A group of Chinese and Japanese economists arrived at a shortfall of 136 million tons in 2010. Reuter, Bangkok, 9-29-95.

9 The energy program director at the East West Institute, Honolulu, quoted by Reuter, Singapore, 9-16-94.

10 Reuter, Beijing, 10-4-95 report on the draft Plan. The employment figures below are drawn from this release and from a Reuter, Beijing, 5-29-95 summary of a report by a Central Committee researcher quoted in the *Economic Daily*.

11 Reuter, Beijing, 1-5-94, quoting the Minister of Agriculture and a provincial labor official, respectively

12 The proposal came from Shenyang, in the Northeast, and was cited approvingly by the official New China News Agency Reuter, Beijing, 7-31-93, 07:41

13 The World Bank, U.S. Bureau of the Census and United Nations projections involve different assumptions as to what China's fertility has been and will be, leading to different conclusions as to the pace of decline.

14 Premier Li Peng to the World Bank President. Reuter, Beijing, 9-20-95.

15 *Beijing Review*, 11-6/12-95.

16 AP Beijing, via Compuserve Executive News Service, 9-30-95. The figure cited was 6.5 million cubic yards. The figure presumably includes industrial sewage.

17 Masayoshi Sadakata of Tokyo University quoted in *Science* July 21, 1995, p.296.

18 Open Media Research Institute, Prague, "Cabinet Ministers Express Concern Over Illegal Chinese Immigration" August 25, 1995.

19 UN World Commission on Environment and Development (or "Brundtland Commission" for its Chair, Gro Harlem Brundtland, Prime Minister of Norway), *Our Common Future* (Oxford; Oxford University Press, 1987), p.213.

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