

## *Redefining Security*

In each of the first four years of this new century, world grain production has fallen short of consumption. The shortfalls in 2002 and 2003, the largest on record, and the smaller ones in 2000 and 2001 were covered by drawing down stocks. These four consecutive shortfalls in the world grain harvest have dropped stocks to their lowest level in 30 years. When there are no longer any stocks to draw down, the only option will be to reduce consumption.<sup>1</sup>

In early 2004, world grain prices were up some 20 percent over previous years. Soybean prices were double the levels of a year earlier. The combination of stronger prices at planting time and the best weather in a decade raised the 2004 grain harvest by 124 million tons to 1,965 million tons, up 7 percent. For the first time in five years, production matched consumption, but only barely. Even with this exceptional harvest, the world was still unable to rebuild depleted grain stocks.<sup>2</sup>

The immediate question is, Will the 2005 harvest be sufficient to meet growing world demand, or will it again fall short? If the latter, then world grain stocks will drop to their lowest level ever—and the world will be in uncharted territory on the food front.

The risk is that another large shortfall could drive

prices off the top of the chart, leading to widespread political instability in low-income countries that import part of their grain. Such political instability could disrupt global economic progress, forcing world leaders to recognize that they can no longer neglect the population and environmental trends that have created harvest shortfalls in four out of the last five years. While terrorism will no doubt remain an important policy issue, the threat posed by growing food insecurity may dwarf it in terms of the number of lives lost and the extent of economic disruption.

### The Tightening Food Supply

The world food supply is tightening because world grain demand is continuing to expand at a robust pace while production growth is slowing as the backlog of unused agricultural technology shrinks, cropland is converted to nonfarm uses, rising temperatures shrink harvests, aquifers are depleted, and irrigation water is diverted to cities.

The world's population is projected to increase by nearly 3 billion by 2050. Two thirds of this growth will occur in the Indian subcontinent and in Africa, the world's hungriest regions. Most of the other 1 billion people will be born in the Middle East, which faces a doubling of its population, and in Latin America, Southeast Asia, and the United States. This projected population increase requires more land not only to produce food but also for living space—homes, factories, offices, schools, and roads.<sup>3</sup>

Some countries are still expanding their cropland, including, for example, Indonesia and Malaysia, both of which are converting rainforest into oil palm plantations. Yet in these two countries, the area of land being cleared is quite small compared with what could happen in Brazil. As noted in Chapter 9, the remaining potential for

expanding the world's cultivated area is concentrated in this large South American country. But when this expansion potential is set against heavy cropland losses elsewhere to residential and industrial construction, to the paving of land for automobiles, and to the spread of deserts, the potential net growth in world cropland is likely to be modest at best.<sup>4</sup>

In many countries the irrigation water supply is shrinking as aquifers are depleted. But even as wells are going dry, irrigation water is being diverted to fast-growing cities. Farmers are getting a smaller share of a diminishing supply. Perhaps even more important, recent research indicates that higher temperatures reduce grain harvests, and at a time when we face the prospect of continually rising temperatures.<sup>5</sup>

In contrast to the last half-century, when the world fish catch quintupled to reach 93 million tons, we cannot expect any growth in the fish catch at all during the next half-century. The growing world demand for seafood must now be satisfied entirely from aquaculture, where fish are fed mostly grain and soymeal. This puts additional pressure on the earth's land and water resources.<sup>6</sup>

Beyond these various environmental and resource trends that are affecting the food prospect, the world's farmers are now also wrestling with a shrinking backlog of agricultural technology. For the world's more progressive farmers, there are few, if any, unused technologies that will substantially raise land productivity. Even more serious, dramatic new yield-raising technologies are likely to be few and far between.<sup>7</sup>

We can also look at the world food prospect through the lens of the Japan syndrome, the sequence of events that occurs in countries that are densely populated before they industrialize. The changes that led to the peaking of grain production and its subsequent decline in Japan,

South Korea, and Taiwan seem certain to affect many other countries. China is the first major one to experience a precipitous decline in its grain harvest. In 1995, when I projected in *Who Will Feed China?* that China's grain harvest would drop, I sensed that this was imminent. But when the downturn came after 1998, it fell faster than I had expected.<sup>8</sup>

As we look at other large, densely populated countries, like India, we know that the same forces are at work, but we do not know exactly when the grain harvest will peak and begin to decline. It could be several years away. But that the preconditions for a decline exist there can be little doubt. Already India has a population density nine times that of the United States. The living space required for the 18 million people added each year to India's population of 1.1 billion means less and less land is available to produce food. Other countries, such as Indonesia, Bangladesh, Pakistan, Egypt, Nigeria, and Mexico, may also soon experience the Japan syndrome as modernization takes land from agriculture.<sup>9</sup>

### The Politics of Food Scarcity

For more than 40 years, international trade negotiations have been dominated by grain-exporting countries—principally the United States, Canada, Argentina, and Australia—pressing for greater access to markets in importing countries. Now the world may be moving into a period dominated not by surpluses but by shortages. In this case, the issue becomes not exporters' access to markets but importers' access to supplies.<sup>10</sup>

The behavior of exporters in recent years shows why grain-importing countries should be concerned. In early September of 2002, Canada—following a harvest decimated by heat and drought—announced that it would export no more wheat until the next harvest. Two months

later, Australia, another key exporter, said that because of a short harvest it would supply wheat only to its traditional buyers. And in the summer of 2003, during the crop-withering heat waves in Europe, the European Union announced that it would not issue any grain export permits until the supply situation improved.<sup>11</sup>

A similar situation developed in Russia following a poor harvest in 2003. Facing a rise in bread prices of more than 20 percent, in January 2004 the government imposed an export tax of 24 euros (\$30) per ton on wheat, effectively ending wheat exports. The tax continued into May.<sup>12</sup>

In late August 2004, China approached Viet Nam to buy 500,000 tons of rice. The leaders in Hanoi responded by saying that the rice could not be supplied until the first quarter of 2005 at the earliest. This is because the Vietnamese government had imposed export limits of 3.5 million tons for the year, or just under 300,000 tons per month, out of fear that growing external demand for its rice would lead to overexporting and thus to rising domestic prices.<sup>13</sup>

This response is of interest because Viet Nam is the world's second-ranking rice exporter after Thailand. Thailand, Viet Nam, and the United States account for 16 million of the 25 million tons of world exports. In addition to China, more than 30 other countries import substantial amounts of rice, ranging from 100,000 tons a year for Colombia and Sri Lanka to 1.8 million tons for Indonesia.<sup>14</sup>

China's rice crop shortfall in 2004 of 10 million tons hangs over the world market like a sword of Damocles. Where the rice will come from is not clear. What China may do in trying to import such large quantities is simply drive up world rice prices. If it had attempted to cover its shortfall in 2004 entirely by imports, world rice prices

would almost certainly have doubled or tripled, as they did in 1972–74, forcing low-income rice-consumers to tighten their belts.<sup>15</sup>

The big test of the international community's capacity to manage scarcity may come when China turns to the world market for massive imports of 30, 40, or 50 million tons of grain per year—demand on a scale that could quickly overwhelm world grain markets. When this happens, China will have to look to the United States, which controls nearly half the world's grain exports.<sup>16</sup>

This will pose a fascinating geopolitical situation: 1.3 billion Chinese consumers, who have a \$120-billion trade surplus with the United States—enough to buy the entire U.S. grain harvest twice—will be competing with Americans for U.S. grain, driving up food prices. In such a situation 30 years ago, the United States would simply have restricted exports, but today it has a stake in a politically stable China. The Chinese economy is not only the engine powering the Asian economy, it is also the only large economy worldwide that has maintained a full head of steam in recent years.<sup>17</sup>

Within the next few years, the United States may be loading one or two ships a day with grain for China. This long line of ships stretching across the Pacific, like an umbilical cord providing nourishment, may link the two economies much more closely than ever before. Managing this flow of grain so as to satisfy the needs of consumers in both countries may become one of the leading foreign policy challenges of this new century.

The risk is that China's entry into the world market will drive grain prices so high that many low-income developing countries will not be able to import enough grain. This in turn could lead to political instability on a scale that will disrupt global economic progress. What began with the neglect of environmental trends that are

impairing efforts to expand food production could translate into political instability on a scale that interferes with international trade and capital flows, thus halting economic progress. At this point, it will be clear that our economic future depends on addressing long-neglected environmental trends.

How exporting countries make room for China's vast needs in their export allocations will help determine how the world addresses the stresses associated with outgrowing the earth. How low-income, importing countries fare in this competition for grain will also tell us something about future political stability. And, finally, how the United States responds to China's growing demands for grain even as it drives up grain and food prices for U.S. consumers will tell us much about the shape of the new world order.

If substantially higher grain prices are needed to bring additional agricultural resources into play, whether in boosting water productivity, which effectively expands the supply, or bringing new land into play in Brazil, how will the world adjust? It may be that the *laissez-faire*, independent decisionmaking of national governments will have to blend into a more coordinated approach to managing food supplies in a time of scarcity.

Unfortunately, the government of China contributes to global food insecurity by refusing to release data on its grain stocks, leaving the international community to try and estimate them independently. This leads to a great deal of uncertainty and confusion, as can be seen in three substantial revisions of estimates for China's grain stocks in the last four years by the U.S. Department of Agriculture (USDA) and the Food and Agriculture Organization (FAO). While holding this information close to the vest gives Chinese grain buyers an advantage in the world market, it makes it extremely difficult for the world to

plan for, and thus respond to, potentially huge future import needs.<sup>18</sup>

Because the last half-century has been dominated by excessive production and market surpluses, the world has had little experience in dealing with the politics of scarcity outside a brief period in 1972–74. In 1972, with a poor domestic harvest in prospect, the Soviets entered the world wheat market secretly and managed to tie up almost all the world's exportable supplies of wheat before governments of either exporting or importing countries realized what was happening. When this was followed by bad weather and below-average harvests over the next two years, world wheat and rice prices doubled, creating serious problems for importers. The United States, which accounted for half of the world's grain exports, restricted sales to certain countries; even food aid shipments favored "friendly countries"—those that supported the United States in U.N. votes, for example.<sup>19</sup>

As surpluses are replaced with scarcity, there is a need to pay more attention to carryover grain stocks, the amount in the bin when the new harvest begins. FAO has established a minimum-security stocks target of 70 days of consumption. Once stocks drop below this level, grain prices become volatile, often driven by the latest weather forecast in a key food-producing country. With stocks at 63 days of consumption in 2004, a major shortfall in one or two major food-producing regions in 2005 could create chaos in world grain markets. Yet despite the importance of this issue, it gets little attention at the U.N. Security Council. Nor has the G-8, the group of eight large industrial countries, focused on it in annual meetings.<sup>20</sup>

One reason food shortages do not get the attention they once did is because famine, in effect, has been redefined. At one time, famine was a geographic phenomenon. When a country or region had a poor harvest,

its people often faced famine. Given the growing integration of the world grain economy and today's capacity to move grain around the world, famine is concentrated much less in specific geographic regions and much more among income groups. Food shortages now translate into higher worldwide prices that affect low-income people throughout the world, forcing many to try to tighten their belts when there are no more notches left.

In the event of life-threatening grain price rises, a tax on livestock products could help alleviate temporary shortages. This would reduce consumption of grain-fed livestock products—meat, milk, and eggs—and thus free up for human consumption a small share of the grain normally fed to livestock and poultry. As noted earlier, in the United States, a reduction in grain consumption per person from 800 to 700 kilograms by moving down the food chain somewhat would not only leave most Americans healthier, it would also reduce grain consumption by some 30 million tons. That would be enough to feed 150 million people in low-income countries. At a time when grain stocks are at an all-time low and the risk of dramatic price jumps is higher than at any time in a generation, a tax on livestock products is the one safety cushion that could be used to buy time to stabilize population and restore economic stability in the world food economy.<sup>21</sup>

### Stabilizing the Resource Base

Future food security depends on stabilizing four key agricultural resources: cropland, water, rangeland, and the earth's climate system. Stabilizing the farmland base means protecting it from both soil erosion and the conversion to nonfarm uses. In China, for example, where the grain harvested area fell from 90 million hectares in 1999 to 77 million hectares in 2004, arresting the shrinkage depends on halting the expansion of deserts and con-

trolling the conversion of grainland to nonfarm uses.<sup>22</sup>

Protecting water resources means stabilizing water tables. The overdrafting that lowers water tables also raises the energy used for pumping. For example, in some states in India half of all electricity is used for water pumping. Higher pumping costs ultimately mean higher food production costs.<sup>23</sup>

Protecting rangeland is an integral part of the food security formula not only because damage to rangeland from overgrazing reduces the livestock carrying capacity, but also because the dust storms that follow devegetation of the land can disrupt economic activity hundreds of miles away. The drifting sand that follows the conversion of rangeland to desert can also invade farming areas, rendering cultivation impossible.

Most important, we need to stabilize the climate system. Agriculture as we know it has evolved over 11,000 years of rather remarkable climate stability. The negative effect of higher temperatures on grain yields underlines the importance of stabilizing climate as quickly as possible.<sup>24</sup>

Stabilizing any one of these resources is demanding, but our generation faces the need to do all four at the same time. This is a demanding undertaking in terms of leadership time and energy and also in financial terms. As noted earlier, desert remediation in China alone will require estimated expenditures of some \$28 billion.<sup>25</sup>

It may seem obvious that if water tables start to fall and wells begin to go dry, alarm bells would ring and governments would launch an immediate effort to reduce pumping and bring demand into balance with supply by adopting water conservation measures. But not one of the scores of countries where water levels are falling has succeeded in stabilizing its water tables.

Protecting the world's grainland is equally difficult. Advancing deserts are a formidable threat in countries

such as Mexico, Nigeria, Algeria, Iran, Kazakhstan, India, and China. If governments continue to treat the symptoms of desertification and fail to address the root causes, such as continuing population growth and excessive livestock numbers, the deserts will continue to advance.<sup>26</sup>

Shielding cropland from nonfarm demands can also be politically complex. The cropland-consuming trends that are an integral part of the modernization process, such as building roads, housing, and factories, are difficult to arrest, much less reverse. And yet the world as a whole cannot continue indefinitely to lose cropland without eventually facing serious trouble on the food front.

Just understanding the complex of issues we are facing on the food security front is difficult. Fashioning an effective response and then implementing it is even more so. This is, in a sense, an enormous educational challenge because it requires national political leaders to master these difficult issues. If they do not, there is little chance that we will arrest the accelerating deterioration in agriculture's natural support systems and prevent the economic decline that eventually will follow.

### A Complex Challenge

When grain harvests fell short, stocks declined, and prices rose during the last half of the twentieth century, there was a standard response. At the official level, the U.S. government would return to production part or all of the cropland idled under its commodity set-aside programs. At the same time, higher prices would encourage farmers worldwide to use more fertilizer, drill more irrigation wells, and invest in other yield-enhancing measures. Production would jump and shortages would disappear.<sup>27</sup>

Now the possible responses to shortages are more

demanding. First, the U.S. cropland set-aside program was dismantled in 1996, depriving the world of this long-standing backup reserve for world grain stocks. As of 2004, only the European Union is holding cropland out of use to limit production, but it is a small area, perhaps 3 million hectares. The United States does have some 14 million hectares (35 million acres) of cropland, much of it highly erodible, in the Conservation Reserve Program under 10-year contracts with farmers, nearly all planted in grass. In an emergency, part of it could be plowed and planted in grain, but it is mostly low-rainfall, low-yielding land in the Great Plains that would expand the U.S. harvest only marginally.<sup>28</sup>

The world today faces a situation far different from that of half a century ago. Diminishing returns are setting in on several fronts, including the quality of new land that can be brought under the plow, the production response to additional fertilizer applications, the opportunity for drilling new irrigation wells, and the potential of research investments to produce technologies that will boost production dramatically.

In 1950, opportunities for expanding the cultivated area were already limited, but there were still some to be found here and there. Together they helped expand the world grainland area by roughly one fifth. Today, in contrast, the only country that has the potential to increase the world grainland area measurably is Brazil. And doing this would raise numerous environmental questions, ranging from soil erosion to decreased carbon sequestration in the plowed areas.<sup>29</sup>

A half-century ago, every country in the world could anticipate using much more fertilizer. Today, using more fertilizer has little effect on production in many countries. And a half-century ago, the use of underground water for irrigation was almost nonexistent. Vast

aquifers were waiting to be tapped, yielding a sustainable supply of irrigation water. Today, drilling more irrigation wells is likely only to hasten the depletion of aquifers and a resulting drop in food production.

Diminishing returns also affect agricultural research. Fifty years ago agricultural scientists were just beginning to adapt the high-yielding dwarf wheats and rices and the hybrid corn to widely varying growing conditions around the world. Today the plant breeding focus has shifted from raising yields to using biotechnology to develop varieties that are insect-resistant or herbicide-tolerant. Plant breeding advances may still raise yields 5 percent here or perhaps 15 percent there, but the potential for dramatic gains appears limited.<sup>30</sup>

The world has changed in other ways. As world population and the global economy expanded dramatically over the last half-century, the world quietly moved into a new era, one in which the economy began pressing against the earth's natural limits. In this new situation, activities in one economic sector can affect another. Historically, for example, what happened in the transport sector had little effect on agriculture. But in a world with 6.3 billion people, most of whom would like to own a car, auto-centered transport systems will consume a vast area of cropland.<sup>31</sup>

In the societies that first turned to cars as the principal means of transportation, there was no need for the transportation minister to consult with the agriculture minister. During the earlier development of the United States, for example, there was more than enough land for crops and cars. Indeed, throughout much of this era farmers were paid to hold land out of production. Now that has changed. Food security is directly affected by transportation policy today.

If densely populated countries like China and India

turn to cars as the primary means of transportation, they will pit affluent automobile owners against low-income food consumers in the competition for land. These nations simply do not have enough land to support hundreds of millions of cars and to feed their people.

The competition between cars and people for resources does not stop here. Some key food-producing countries, including the United States, are producing ethanol from grain for automotive fuel. In 2004, the United States used some 30 million tons of its 278-million-ton corn harvest to manufacture ethanol for cars. This tonnage, requiring nearly 4 million hectares (10 million acres) to produce, would be enough to feed 100 million people at average world consumption levels. Other countries building grain-fed ethanol plants include Canada and China. The competition between affluent motorists and low-income food consumers is thus not only for the land used to produce food, but also for the food itself.<sup>32</sup>

The other side of this coin is that if grain prices rise sharply, ethanol plants are likely to close, as they did in 1996 when grain prices went up temporarily. This would free up grain for food or feed, thus providing an additional buffer when world grain supplies tighten.<sup>33</sup>

The loss of momentum on the food front in recent years argues for reassessing the global population trajectory. Indeed, population policymakers may hold the key to achieving a humane balance between population and food. We can no longer take population projections as a given. The world cannot afford for any women to be without family planning advice and contraceptives. Today, however, an estimated 137 million women want to limit the size of their families but lack access to the family planning services needed to do so. Eradicating hunger depends on filling the family planning gap and creating the social conditions that will accelerate the shift to smaller families.<sup>34</sup>

Food security is affected not only by the food-population equation, but also by the water-population equation and the efforts of water resource ministries to raise water productivity. Indeed, since 70 percent of world water use is for irrigation, eradicating hunger may now depend on a global full-court press to raise water productivity. Everyone knows it takes water to produce food, but we often do not realize how water-intensive food production is and how quickly water shortages can translate into food shortages. The ministry of health and family planning needs to cooperate not only with the ministry of agriculture but also with the ministry of water resources. Those living in land-hungry, water-short countries need to know how their childbearing decisions will affect the next generation's access to water and to food.<sup>35</sup>

It is perhaps indicative of the complexity of the times in which we live that decisions on energy development made in ministries of energy may have a greater effect on the earth's temperature, and hence future food security, than decisions made in ministries of agriculture. Even so, ministers of energy are rarely involved in food security planning.

Ensuring future food security therefore can no longer be left to ministries of agriculture alone. Food security is now directly dependent on policy decisions in the ministries of health and family planning, water resources, transportation, and energy. This dependence of food security on an integrated effort by several departments of government is new. And because it has emerged so quickly, governments are lagging far behind in their efforts to coordinate these departments and their agendas.

One of the essentials for success in this new situation is strong national political leaders. In the absence of competent leaders who understand the complex interaction of these issues, the cooperation needed to ensure a



country's future food security may simply not be forthcoming. In the absence of such leadership, a deterioration in the food situation may be unavoidable.

The integration that is needed across the ministries of government is also called for at the international level. Unfortunately, there may be even less contact among the relevant U.N. agencies such as FAO, the U.N. Population Fund (UNFPA), and the U.N. Environment Programme (UNEP) than there is within national ministries. There is no independent water resources agency, nor is there a U.N. agency responsible for transportation. The three U.N. agencies that particularly need to work closely together are FAO, UNFPA, and UNEP.

At another level, the world needs more sophisticated agricultural supply and demand projections. At present, whether they come from FAO, the World Bank, or the USDA, these are largely done by agricultural economists. In a situation where water supplies and temperature levels may have a greater effect on food production in some countries than advancing agricultural technology does, meaningful projections require inputs not only from economists but also from hydrologists, meteorologists, and agronomists.

There is a remarkable lack of data on the status of the world's underground water resources. Few countries systematically gather and report data on changes in water table levels. Even fewer data are available on the thickness of aquifers. And there are almost no projections that tell us when aquifer depletion is likely to occur.

Aside from China, the other big question mark hanging over the world food prospect is Brazil—the most important question being how much of its potential for expanding food production it plans to exploit. Is Brazil prepared to plow the 75 million hectares of the *cerrado* that is believed to be cultivable? Or does it want to pre-

serve part of this land to protect the region's diversity of wildlife and perhaps its rainfall patterns as well? How much of the Amazon is Brazil prepared to clear for agriculture, either for cattle grazing or for crops? What Brazil decides to do in terms of converting the *cerrado* or the Amazon rainforest into cropland and rangeland is directly related to the formulation of population policies in scores of countries. How much should individual countries invest in small-scale water catchment storage, for example? How rigorously should they protect their cropland from conversion to nonfarm uses?<sup>36</sup>

In a world that is increasingly integrated economically, food security is now a global issue. In an integrated world grain market, everyone is affected by the same price shifts. A doubling of grain prices, which is a distinct possibility if we cannot accelerate the growth in grain production, could impoverish more people and destabilize more governments than any event in history. Our future depends on working together to avoid a destabilizing jump in world food prices. Everyone has a stake in stabilizing the agricultural resource base. Everyone has a stake in securing future food supplies. We all have a responsibility to work for the policies—whether in agriculture, energy, population, water use, cropland protection, or soil conservation—that will help ensure future world food security.

The complexity of the challenges the world is facing is matched by the enormity of the effort required to reverse the trends that are undermining future food security. Halting the advancing deserts in China, arresting the fall in water tables in India, and reversing the rise in carbon emissions in the United States are each essential to future world food security. Each will require a strong, new initiative—one that demands a wartime sense of urgency and leadership.

We have inherited the mindset, policies, and fiscal priorities from an era of food security that no longer exists. The policies that once provided food security will no longer suffice in a world where we are pressing against the sustainable yields of oceanic fisheries and underground aquifers and the limits of nature to fix carbon dioxide. Unless we recognize the nature of the era we are entering and adopt new policies and priorities that recognize the earth's natural limits, world food security could begin to deteriorate. If it does, food security could quickly eclipse terrorism as the overriding concern of governments.