



Spiegel Online International
February 11, 2009

WORLDWIDE CRISIS

The Geopolitics of Food Scarcity

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In some countries social order has already begun to break down in the face of soaring food prices and spreading hunger. Could the worldwide food crisis portend the collapse of global civilization?

One of the toughest things for us to do is to anticipate discontinuity. Whether on a personal level or on a global economic level, we typically project the future by extrapolating from the past. Most of the time this works well, but occasionally we experience a discontinuity that we failed to anticipate. The collapse of civilization is such a case. It is no surprise that many past civilizations failed to grasp the forces and recognize signs that heralded their undoing. More than once it was shrinking food supplies that brought about their downfall.

Does our civilization face a similar fate? Until recently it did not seem possible, but our failure to deal with the environmental trends that are undermining the world food economy -- most importantly falling water tables, eroding soils, and rising temperatures -- forces the conclusion that such a collapse is possible.

These trends are taking a significant toll on food production: In six of the last eight years world grain production has fallen short of consumption, forcing a steady drawdown in stocks. World carryover stocks of grain (the amount remaining from the previous harvest when the new harvest begins) have dropped to only 60 days of consumption, a near record low. Meanwhile, in 2008 world grain prices have climbed to the highest level ever.

The current record food price inflation puts another severe stress on governments around the world, adding to the other factors that can lead to state failure. Even before the 2008 climb in grain prices, the list of failing states was growing. Now even more governments in many more low and middle-income countries that import grain are in danger of failing as food prices soar. With rising food costs straining already beleaguered states, is it not difficult to imagine how the food crisis could portend the failure of global civilization itself.

Today we are witnessing the emergence of a dangerous politics of food scarcity, one in which individual countries act in their narrowly defined self-interest and subsequently accelerate the deterioration of global equilibrium. This began in 2007 when leading wheat-exporting countries such as Russia and Argentina limited or banned exports in an attempt to counter domestic food price rises. Vietnam, the world's second-largest rice exporter after Thailand, banned exports for several months for the same reason. While these moves may reassure those living in exporting countries, they create panic in the scores of countries that import grain.

In response to restrictions by these and other grain exporters, grain-importing countries are trying to nail down long-term bilateral trade agreements in order to secure future food supplies. The Philippines, no longer able to count on rice from the world market when it needs it, negotiated a three-year deal with Vietnam for a guaranteed 1.5 million tons of rice each year. Other importers are seeking similar arrangements.



Food import anxiety is also spawning an entirely new genre of trade agreements as food-importing countries seek to buy or lease large blocks of land to farm in other countries. Libya, which imports close to 90 percent of its grain and is understandably anxious about access to supplies, has leased 250,000 acres of land in Ukraine to grow wheat for its own people in exchange for access to one of its oil fields. Egypt is seeking similar land acquisition in Ukraine in exchange for access to its natural gas. China has the most ambitious "farming abroad" goals of all: In 2007 the country signed a memorandum of understanding to farm 2.5 million acres in the Philippines, an area equal to roughly 10 percent of that country's farmland. But this agreement, quietly entered into by government officials, was later abandoned by Manila as rice supplies tightened and as local farmers voiced concern. China is now looking for long-term leases of land in other countries, including Australia, Russia, and Brazil.

No Temporary Shortage

The current surge in world grain prices is trend-driven; some of these trends expand demand and others restrict growth in supply. On the demand side, these trends include world population growth of 70 million people a year, a growing number of people consuming more grain-intensive products, and the massive diversion of US grain to ethanol-fuel distilleries. During the last few years, the United States's use of grain for ethanol has nearly doubled the annual growth in world grain consumption from 19 million metric tons to more than 36 million metric tons.

The additional demand for grain associated with rising affluence varies widely among countries. People in low-income countries where grain supplies 60 percent of calories, such as India, directly consume nearly 200 kilograms of grain per year. In affluent countries like the United States and Canada, annual grain consumption per person is close to 800 kilograms, but about 90 percent of that is consumed indirectly as meat, milk, and eggs. The potential for additional grain consumption as incomes rise among low-income consumers is huge. To illustrate, the current world grain harvest of around two billion metric tons could feed 10 billion Indians at current consumption levels but only 2.5 billion Americans.

This potential growth in demand for grain is huge but it pales next to that for automotive fuel production. The automotive demand for crop-based fuels is insatiable. If the food value of grain is less than its fuel value, the market will move the grain into the energy economy. Thus as the price of oil rises, the price of grain follows it upward. The United States, in a misguided effort to reduce its dependence on foreign oil by substituting grain-based fuels, is generating global food insecurity on a scale not seen before.

Water Shortages Mean Food Shortages

Of all the environmental trends that are shrinking the world's food supplies, the most immediate is water shortages. In a world where 70 percent of all water use is for irrigation, this is no small matter. The drilling of millions of irrigation wells has pushed water withdrawal in many countries beyond recharge rates from rainfall, leading to groundwater mining. As a result, water tables are now falling in countries that contain half the world's people, including the big three grain producers -- China, India, and the United States.

Aquifer depletion poses a particularly serious threat to China and India where between roughly 80 and 60 percent, respectively, of the grain harvest comes from irrigated land. This compares with only 20 percent in the United States. Most aquifers can be replenished. When they are depleted, the pumping is necessarily reduced to the rate of recharge. Fossil aquifers, however, are not replenishable: For these, depletion brings pumping to an end. Farmers who lose their irrigation water can return to lower-yield dryland farming if



rainfall permits, but in more arid regions, such as the southwestern United States or the Middle East, it can mean the end of agriculture altogether.

Nowhere is the shrinkage of irrigated agriculture more dramatic than in Saudi Arabia, a country as water-poor as it is oil-rich. After the Arab oil export embargo in the 1970s, the Saudis realized they were vulnerable to a counter embargo on grain. To become self-sufficient in wheat, they developed a heavily subsidized irrigated agriculture based on pumping water from a fossil aquifer over a half-mile below the surface. In early 2008, with the aquifer largely depleted, the Saudis announced that they will phase out wheat production by 2016 -- after being self-sufficient in this staple food for over 20 years. Saudi Arabia will then be importing roughly 14 million metric tons of wheat, rice, corn, and barley for its Canada-sized population of 30 million people. It is the first country to publicly reveal how aquifer depletion will shrink its grain harvest.

Falling water tables are also adversely affecting harvests in many other countries. In China, a groundwater survey revealed that the water table under the North China Plain, an area that produces over half of the country's wheat and a third of its corn, is falling fast. Overpumping has largely depleted the shallow aquifer, forcing well drillers to turn to the region's deep aquifer, which is not replenishable. The aquifer is dropping at a rate of nearly three meters per year. A 2001 World Bank report predicted "catastrophic consequences for future generations" unless water use and supply can quickly be brought back into balance.

As water tables fall and irrigation wells go dry, China's wheat crop, the world's largest, is shrinking. After peaking at 111 million metric tons in 1997, the harvest fell to 103 million metric tons this year, a drop of seven percent within a decade. During the same period, production of rice, a water-guzzling crop, dropped six percent from 127 million to 119 million tons. Already dependent on imports for nearly 70 percent of its soybeans, China may soon be importing massive quantities of grain as well.

In India the margin between food consumption and survival is even more precarious. The country's farmers have drilled 21 million irrigation wells, with the result that water tables are falling in almost every state. In a survey of India's water situation, British author and journalist Fred Pearce reported in August 2004 in *New Scientist* magazine that "half of India's traditional hand-dug wells and millions of shallower tube wells have already dried up, bringing a spate of suicides among those who rely on them. Electricity blackouts are reaching epidemic proportions in states where half of the electricity is used to pump water from depths of up to a kilometer."

The progressive worldwide depletion of aquifers is making further expansion of food production more difficult. After nearly tripling from 94 million hectares in 1950 to 276 million hectares in 2000, the world's irrigated area abruptly stopped growing. For the world's farmers, peak water apparently has arrived.

Cropland Losses

In addition to losses from erosion, cropland is also being converted to non-farm uses. Although there are no reliable worldwide data on cropland conversion, it is clear that whether it is housing developments marching up California's Central Valley, the thousands of factories being built each year in the Yangtze River Basin, or similar losses elsewhere, some of the world's most productive cropland is being lost to construction. Meanwhile, the world automobile fleet is growing by 23 million cars per year, and is claiming ever more cropland for roads, highways, and parking lots. To illustrate this, imagine if China were one day to achieve the Japanese automobile ownership rate of one car for every two people. The country would then have a fleet of 650 million motor vehicles, compared with only 35 million today. Since at least 0.4



hectares of land has to be paved for every 20 vehicles added to the fleet, this would require paving nearly 13.3 million hectares of land -- an area equal to half the riceland in China. Worldwide, the average grainland per person shrank from 2.4 hectares in 1950 to well below 1.2 hectares in 2007. This area, smaller than a building lot in an affluent US suburb, will soon shrink to 0.8 hectares if current population growth trends continue.

Rising Temperatures, Falling Yields

Global warming is another pervasive environmental threat to food security. Agriculture as it exists today was shaped by a climate system that despite occasional blips has remained remarkably stable over farming's 11,000-year history. Since crops were developed to maximize yields in this long-standing climate regime, climate change means agriculture will be increasingly out of sync with its natural environment. In a July 2004 study published by the US National Academy of Sciences, a team of scientists from several countries confirmed the rule of thumb emerging among crop ecologists -- that a one-degree Celsius temperature rise above the norm lowers wheat, rice, and corn yields by 10 percent. The scientists concluded that "temperature increases due to global warming will make it increasingly difficult to feed earth's growing population."

Aside from the direct effect of higher temperatures, ice melting indirectly affects agriculture over the longer term. The Greenland ice sheet, which is melting at an accelerating rate, will raise sea level seven meters if it melts entirely. If we continue with business-as-usual, sea level could easily rise by two meters during this century. This would quickly inundate rice-growing river deltas such as those of the Ganges in Bangladesh and the Mekong in Vietnam. A World Bank map shows that a one-meter rise in sea level would flood close to half of the riceland in Bangladesh, proportionately shrinking the rice supply of the country's 161 million people.

Crop Yields Plateauing

Even as these multiple environmental and resource trends threaten future food security, the shrinking backlog of unused agricultural technology is slowing the rise in land productivity. Between 1950 and 1990, the world's farmers raised grain yield per hectare by more than two percent a year, exceeding the growth of population. But since then yield growth has slowed to just over one percent a year, scarcely half the earlier rate. Some commentators point to genetically modified crop strains as a way out of our predicament, but GM crops have not dramatically raised yields, nor are they likely to do so in the near future.

The bottom line is that new harvest-expanding technologies are ever more difficult to come by as crop yields move closer to the inherent limits of photosynthetic efficiency. This limit in turn establishes the upper bounds of the earth's biological productivity, which ultimately will determine the earth's human carrying capacity. The question -- at least for now -- is not will the world grain harvest continue to expand, but will it expand fast enough to keep pace with rapidly growing demand. If we continue down the current path it is not likely to do so, which means that food supplies will tighten further. There is a real risk that we could soon face civilization-threatening food shortages.

Signs of food stress are everywhere. After declining for several decades, the number of chronically hungry and malnourished people in developing countries bottomed out in 1996 at 800 million and has been climbing since. In 2006 it exceeded 850 million and in 2007 it climbed to over 980 million. The US Department of Agriculture projects the number will reach 1.2 billion by 2017. For the first time in several



decades this basic social indicator is moving in the wrong direction, and it is doing so at a record rate and with disturbing social consequences. No country is immune to the effects of tightening food supplies, not even the United States. If China turns to the world market for massive quantities of grain, as it recently has done for soybeans, it will undoubtedly look to the United States, which dominates world grain exports. For US consumers, the prospect of competing for the US grain harvest with 1.3 billion Chinese consumers with fast-rising incomes is a nightmare scenario. It would be tempting for the United States to restrict exports, but this is not an option with China which now holds well over one trillion US dollars. Like it or not, US consumers will share their grain with Chinese consumers regardless of how high food prices rise.

If the food crisis worsens, national restrictions on grain exports coupled with various bilateral arrangements could tie down much of the exportable supply of grain, making it increasingly difficult if not impossible for weaker, less affluent countries to find grain to import. Many countries heavily dependent on imports could be left out, and the result would be hundreds of millions of desperate people. Desperate people do desperate things: They riot, they fight over food, they overthrow governments, and they mass migrate to more food-secure countries.

In many countries the social order has already begun to break down in the face of soaring food prices and spreading hunger. Deadly food riots broke out in a number of countries in 2008. In Egypt several people died in fights in government-subsidized bread lines. Food riots in Yemen turned deadly, taking at least a dozen lives. In Cameroon the food riot death toll was twice as high.

Falling Yields, Failing States

The deteriorating world food situation is not occurring in a vacuum: it comes at a time when there is a growing backlog of unresolved problems, many of them associated with a failure by developing countries to slow population growth. Continuing population growth on a planet already overburdened with human demands is politically weakening scores of countries. Under stress, inter-nal social conflicts develop between differing religious, ethnic, tribal, and racial groups, sometimes leading to genocide as in Rwanda and Sudan.

Nearly all of the projected 2.4 billion people to be added to world population by mid-century will be born in countries where agriculture's natural support systems are already deteriorating in the face of excessive demands. As water tables fall, soils erode, and temperatures rise in countries like India, Pakistan, Ethiopia, Nigeria, and Mexico, the risk of social collapse grows. We have entered a new era in international affairs: In the last century it was heavily armed superpowers that threatened security, but today it is failing states. It is not the concentration of power but its absence that now threatens us.

Plan B: Our Only Option

Business as usual is no longer a viable option. The current world food crisis can be alleviated only by altering the trends that are causing it. We need to go to Plan B. This involves extraordinary measures such as stabilizing climate, stabilizing population, eradicating poverty, and restoring agriculture's natural support systems, including soils and aquifers.

Plan B has four components: cut carbon emissions 80 percent by 2020, stabi-lize the world population at eight billion by 2040, eradicate poverty, and restore forests, soils, and aquifers. The 80 percent cut in net carbon dioxide emissions can be achieved by systematically raising energy efficiency throughout the world economy, investing massively in the development of renewable sources of energy, banning deforestation



worldwide, and planting billions of trees to sequester carbon. The transition from fossil fuels to renewable energy is driven by tax restructuring, namely raising the tax on carbon while offsetting it with a reduction in income taxes.

Stabilizing population and eradicating poverty go hand in hand. The key to accelerating the shift to smaller families is eradicating poverty. This means ensuring education for all children, girls as well as boys. It means providing rudimentary, village-level health care so that people can be confident their children will survive to adulthood. And it means giving women everywhere access to reproductive health care and family planning services.

The fourth component, restoring the earth's natural systems and resources, encompasses a worldwide initiative to arrest the fall in water tables by raising water productivity, similar to the highly successful worldwide initiative to raise land productivity that was launched a half century ago and that has nearly tripled grain yield per hectare. Raising water productivity means shifting to more efficient irrigation systems and to more water-efficient crops. In some countries this means, for example, more wheat and less rice. And for industries and cities, it means continuously recycling water. As industries and cities recycle water, more will be available for irrigation. This component also includes a worldwide soil conservation effort, with such measures as terracing, planting tree shelter belts, and adopting minimum tillage practices.

Within the environmental community, we have talked for decades about saving the planet. But now we have a new challenge: to save civilization itself. To adopt Plan B is to embrace hope. We can continue with business as usual, leaving the next generation a world where failing states multiply until civilization descends into chaos. Or we can start working now to leave our children a better world, a world that is more secure, not less so.

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