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Selling Our Future

From time to time I go back and read about earlier civilizations that declined and collapsed, trying to understand the reasons for their demise. More often than not shrinking food supplies were responsible. For the Sumerians, rising salt levels in the soil—the result of a flaw in their irrigation system—brought down wheat and barley yields and eventually the civilization itself.¹

For the Mayans, soil erosion exacerbated by a series of intense droughts apparently undermined their food supply and their civilization. For other early civilizations that collapsed, it was often soil erosion and the resulting shrinkage in harvests that led to their decline.²

Does our civilization face a similar fate? Until recently it did not seem possible. I resisted the idea that food shortages could also bring down our early twenty-first century global civilization. But our continuing failure to reverse the environmental trends that are undermining the world food economy forces me to conclude that if we continue with business as usual such a collapse is not only possible but likely.

The historic grain price climb in the last few years underlines

the gravity of the situation. From mid-2006 to mid-2008, world prices of wheat, rice, corn, and soybeans roughly tripled, reaching historic highs. It was not until the global economic crisis beginning in 2008 that grain prices receded somewhat. But even then they were still well above the historical level.³

The world has experienced several grain price surges over the last half-century, but none like this. These earlier trends were event-driven—a monsoon failure in India, a severe drought in the Soviet Union, or a crop-shrinking heat wave in the U.S. Midwest. The price surges were temporary, caused by weather-related events that were usually remedied by the next harvest. The record 2006–08 surge in grain prices is different. It is trend-driven. This means that working our way out of this tightening food situation depends on reversing the trends that are causing it, such as soil erosion, falling water tables, and rising carbon emissions.

As a result of persistently high food prices, hunger is spreading. One of the United Nations Millennium Development Goals is to reduce hunger and malnutrition. In the mid-1990s, the number of people in this category had fallen to 825 million. But instead of continuing to decline, the number of hungry started to edge upward, reaching 915 million at the end of 2008. It then jumped to over 1 billion in 2009. With business as usual, I see a combination of the projected growth in population, the planned diversion of grain to produce fuel for cars, spreading shortages of irrigation water, and other trends combining to push the number of hungry people to 1.2 billion or more by 2015.⁴

Rising food prices and the swelling ranks of the hungry are among the early signs of a tightening world food situation. At a time when progress is seen as almost inevitable, this recent reversal on the food front is a disturbing setback. More and more, food is looking like the weak link in our civilization, much as it was for the earlier ones whose archeological sites we now study.

Food: The Weak Link

As the world struggles to feed all its people, farmers are facing several trying trends. On the demand side of the food equation are three consumption-boosting trends: population growth, the growing consumption of grain-based animal protein, and, most recently, the massive use of grain to fuel cars.

On the supply side, several environmental and resource trends are making it more difficult to expand food production fast enough. Among the ongoing ones are soil erosion, aquifer depletion, crop-shrinking heat waves, melting ice sheets and rising sea level, and the melting of the mountain glaciers that feed major rivers and irrigation systems. In addition, three resource trends are affecting our food supply: the loss of cropland to non-farm uses, the diversion of irrigation water to cities, and the coming reduction in oil supplies.

The first trend of concern is population growth. Each year there are 79 million more people at the dinner table. Unfortunately, the overwhelming majority of these individuals are being added in countries where soils are eroding, water tables are falling, and irrigation wells are going dry. If we cannot get the brakes on population growth, we may not be able to eradicate hunger.⁵

Even as our numbers are multiplying, some 3 billion people are trying to move up the food chain, consuming more grain-intensive livestock products. At the top of the food chain ranking are the United States and Canada, where people consume on average 800 kilograms of grain per year, most of it indirectly as beef, pork, poultry, milk, and eggs. Near the bottom of this ranking is India, where people have less than 200 kilograms of grain each, and thus must consume nearly all of it directly, leaving little for conversion into animal protein.⁶

Beyond this, the owners of the world's 910 million automobiles want to maintain their mobility, and most are not particularly concerned about whether their fuel comes from an oil well or a corn field. The orgy of investment in ethanol fuel distilleries that followed the 2005 surge in U.S. gas prices to \$3 a gallon after Hurricane Katrina raised the annual growth in world grain consumption from roughly 20 million tons per year to more than 40 million tons in both 2007 and 2008, creating an epic competition between cars and people for grain.⁷

Turning to the supply-side constraints, soil erosion is currently lowering the inherent productivity of some 30 percent of the world's cropland. In some countries, such as Lesotho and Mongolia, it has reduced grain production by half or more over the last three decades. Kazakhstan, the site of the Soviet Virgin Lands project a half-century ago, has abandoned 40 percent of its grainland since 1980. Vast dust storms coming out of sub-

Saharan Africa, northern China, western Mongolia, and Central Asia remind us that the loss of topsoil is not only continuing but expanding.⁸

In contrast to the loss of topsoil that began with the first wheat and barley plantings, falling water tables are historically quite recent, simply because the pumping capacity to deplete aquifers has evolved only in recent decades. As a result, water tables are now falling in countries that together contain half the world's people. As overpumping spreads and as aquifer depletion continues, the wells are starting to go dry. Saudi Arabia has announced that because its major aquifer, a fossil (non-replenishable) aquifer, is largely depleted, it will be phasing out wheat production entirely by 2016. A World Bank study shows that 175 million people in India are being fed by overpumping aquifers. In China, this problem affects 130 million people.⁹

Climate change also threatens food security. After a certain point, rising temperatures reduce crop yields. For each 1 degree Celsius rise in temperature above the norm during the growing season, farmers can expect a 10-percent decline in wheat, rice, and corn yields. Since 1970, the earth's average surface temperature has increased by 0.6 degrees Celsius, or roughly 1 degree Fahrenheit. And the Intergovernmental Panel on Climate Change projects that the temperature will rise by up to 6 degrees Celsius (11 degrees Fahrenheit) during this century.¹⁰

As the earth's temperature continues to rise, mountain glaciers are melting throughout the world. Nowhere is this of more concern than in Asia. It is the ice melt from glaciers in the Himalayas and on the Tibetan Plateau that sustain the major rivers of India and China, and the irrigation systems that depend on them, during the dry season. In Asia, both wheat and rice fields depend on this water. China is the world's leading wheat producer. India is number two. (The United States is third.) These two countries also dominate the world rice harvest. Whatever happens to the wheat and rice harvests in these two population giants will affect food prices everywhere. Indeed, the projected melting of the glaciers on which these two countries depend presents the most massive threat to food security humanity has ever faced.¹¹

According to the latest information on the accelerating melting of the Greenland and West Antarctic ice sheets, ice melt

combined with thermal expansion of the oceans could raise sea level by up to 6 feet during this century. Every rice-growing river delta in Asia is threatened by the melting of these ice sheets. Even a 3-foot rise would devastate the rice harvest in the Mekong Delta, which produces more than half the rice in Viet Nam, the world's number two rice exporter. A World Bank map shows that a 3-foot rise in sea level would inundate half the rice-land in Bangladesh, home to 160 million people. The fate of the hundreds of millions who depend on the harvests in the rice-growing river deltas and floodplains of Asia is inextricably linked to the fate of these major ice sheets.¹²

As pressures on land-based food sources mounted after World War II, the world turned to the oceans for animal protein. From 1950 to 1996 the world fish catch climbed from 19 million to 94 million tons. But then growth came to a halt. We had reached the limits of the oceans before those of the land. Since 1996, growth in the world seafood supply has come almost entirely from fish farms. The spiraling demand for fish feed, most of it in the form of grain and soybean meal, is further intensifying pressure on the earth's land and water resources.¹³

Advancing deserts—the result of overgrazing, overplowing, and deforestation—are encroaching on cropland in Saharan Africa, the Middle East, Central Asia, and China. Advancing deserts in northern and western China have forced the complete or partial abandonment of some 24,000 villages and the cropland surrounding them. In Africa, the Sahara is moving southward, engulfing cropland in Nigeria. It is also moving northward, invading wheat fields in Algeria and Morocco.¹⁴

Farmers are losing cropland and irrigation water to non-farm uses. The conversion of cropland to other uses looms large in China, India, and the United States. China, with its massive industrial and residential construction and its paving of roads, highways, and parking lots for a fast-growing automobile fleet, may be the world leader in cropland loss. In the United States, suburban sprawl is consuming large tracts of farmland.

With additional water no longer available in many countries, growing urban thirst can be satisfied only by taking irrigation water from farmers. Thousands of farmers in thirsty California find it more profitable to sell their irrigation water to Los Angeles and San Diego and leave their land idle. In India, villages are

selling the water from their irrigation wells to nearby cities. China's farmers are also losing irrigation water to the country's fast-growing cities.¹⁵

Lingering in the background is the prospect of declining oil use as a result of either declining production or efforts to cut carbon emissions—or, more likely, some combination of the two. The tripling of the world grain harvest over the last half-century is closely tied to oil. Today oil figures prominently in the farm economy, used in tillage, irrigation, and harvesting. Once oil production turns downward, countries will compete for a shrinking supply as they try to keep their agriculture producing at a high level. It was relatively easy to expand world food production when oil was cheap and abundant. It will be far more difficult when the price of oil is rising and the supply is declining.¹⁶

Despite the growing need for new techniques to expand production, the backlog of unused agricultural technology is shrinking. In the more agriculturally advanced countries, farmers are using virtually all the available technology to raise land productivity. And agricultural scientists are not finding many new ways to raise yields. In Japan, the first country to launch a sustained rise in grain yield per hectare, rice yield increases have stalled, with little gain over the last 14 years. In China, the rapid rise in rice yields is now history. In both France and Egypt, wheat yields, which are among the world's highest, have been flat for roughly a decade. For the world as a whole, the rise in grainland productivity dropped from 2.1 percent a year from 1950 to 1990 to 1.3 percent from 1990 to 2008.¹⁷

Some commentators point to genetically modified crops as a way out of this predicament. Unfortunately, no genetically modified grains have dramatically raised yields. Nor are they likely to do so. Scientists using conventional plant breeding techniques have already exploited most of the genetic potential for raising crop yields.¹⁸

The bottom line is that harvest-expanding scientific advances 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 its human carrying capacity.¹⁹

As the world's farmers attempt to expand the harvest, the

trends that negatively affect production are partly offsetting advances in technology. The question now is, Could the environmental damage to world agriculture at some point entirely offset the gains from advancing technology, as it has already in Saudi Arabia and Yemen, where water shortages are shrinking grain harvests, or in Lesotho and Mongolia, where soil erosion is reducing harvests?²⁰

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 steadily growing demand.

Business as usual is no longer a viable option. Food security will deteriorate further unless leading countries collectively mobilize to stabilize population, stabilize climate, stabilize aquifers, conserve soils, protect cropland, and restrict the use of grain to produce fuel for cars.

The Emerging Politics of Food Scarcity

As world food security deteriorates, a dangerous geopolitics of food scarcity is emerging in which individual countries, acting in their narrowly defined self-interest, reinforce the negative trends. This began in late 2007 when wheat-exporting countries such as Russia and Argentina limited or banned exports in an attempt to counter domestic food price rises. Viet Nam banned rice exports for several months for the same reason. Several other minor exporters also banned or restricted exports. While these moves reassured those living in the exporting countries, they created panic in the scores of countries that import grain.²¹

At that point, as grain and soybean prices were tripling, governments in grain-importing countries suddenly realized that they could no longer rely on the market for supplies. In response, some countries tried to nail down long-term bilateral trade agreements that would lock up future grain supplies. The Philippines, a leading rice importer, negotiated a three-year deal with Viet Nam for a guaranteed 1.5 million tons of rice each year. A delegation from Yemen, which now imports most of its wheat, traveled to Australia with the hope of negotiating a long-term wheat import deal. Egypt has reached a long-term agreement with Russia for more than 3 million tons of wheat each year. Other importers sought similar arrangements. But in a seller's market, few were successful.²²

The inability to negotiate long-term trade agreements was accompanied by an entirely new genre of responses among the more affluent food-importing countries as they sought to buy or lease for the long term large blocks of land to farm in other countries. As food supplies tighten, we are witnessing an unprecedented scramble for land that crosses national boundaries. Libya, importing 90 percent of its grain and worried about access to supplies, was one of the first to look abroad for land. After more than a year of negotiations it reached an agreement to farm 100,000 hectares (250,000 acres) of land in the Ukraine to grow wheat for its own people. This land acquisition is typical of the many that have introduced a new chapter in the geopolitics of food.²³

What is so surprising is the sheer number of land acquisition agreements that have been negotiated or are under consideration. The International Food Policy Research Institute (IFPRI) has compiled a list of nearly 50 agreements, based largely on a worldwide review of press reports. Since there is no official point of registry of such transactions, no one knows for sure how many such agreements there are. Nor does anyone know how many there will eventually be. This massive acquisition of land to grow food in other countries is one of the largest geopolitical experiments ever conducted.²⁴

The role of government in land acquisition varies. In some cases, government-owned corporations are acquiring the land. In others, private entities are the buyers, with the government of the investing country using its diplomatic resources to achieve an agreement favorable to the investors.

The land-buying countries are mostly those whose populations have outrun their own land and water resources. Among them are Saudi Arabia, South Korea, China, Kuwait, Libya, India, Egypt, Jordan, the United Arab Emirates, and Qatar. Saudi Arabia is looking to buy or lease land in at least 11 countries, including Ethiopia, Turkey, Ukraine, Sudan, Kazakhstan, the Philippines, Viet Nam, and Brazil.²⁵

In contrast, countries selling or leasing their land are often low-income countries and, more often than not, those where chronic hunger and malnutrition are commonplace. Some depend on the World Food Programme (WFP) for part of their food supply. The *Financial Times* reported in March 2009 that

the Saudis celebrated the arrival of the first shipment of rice produced on land they had acquired in Ethiopia, a country where the WFP is currently working to feed 4.6 million people. Another major acquisition site for the Saudis and several other grain-importing countries is the Sudan—ironically the site of the WFP's largest famine relief effort.²⁶

Indonesia has agreed to give Saudi investors access to 2 million hectares (4.9 million acres) of land, much of it to grow rice. The Saudi Binladin Group was negotiating to develop 500,000 hectares of land for rice production in Indonesia's Papua province, but this has apparently been put on hold because of financial constraints.²⁷

For sheer size of investment, China stands out. The Chinese firm ZTE International has secured rights to 2.8 million hectares (6.9 million acres) in the Democratic Republic of the Congo on which to produce palm oil, which can be used either for cooking or to produce biodiesel fuel—indicating that the competition between food and fuel is also showing up in land acquisitions. This compares with the 1.9 million hectares used by the Congo's 66 million people to produce corn, their food staple. Like Ethiopia and Sudan, the Congo also depends on a WFP lifeline. China is also negotiating for 2 million hectares in Zambia on which to produce jatropha, an oilseed-bearing perennial. Among the other countries in which China has acquired land or has plans to do so are Australia, Russia, Brazil, Kazakhstan, Myanmar, and Mozambique.²⁸

South Korea, a leading world corn importer, is a major investor in several countries. With deals signed for some 690,000 hectares (1.7 million acres) in the Sudan for growing wheat, South Korea is one of the leaders in this food security push. For perspective, this land acquisition is nearly three fourths the size of the 930,000 hectares South Korea now uses at home to produce rice, its staple food. The Koreans are also looking at the Russian Far East, where they plan to grow corn and soybeans.²⁹

One of the little noticed characteristics of land acquisitions is that they are also water acquisitions. Whether the land is rain-fed or irrigated, it represents a claim on the water resources in the host country. Land acquisitions in the Sudan that tap water from the Nile, which is already fully utilized, may simply mean that Egypt will get less water from the river—making it even

more dependent on imported grain.³⁰

These bilateral land acquisitions raise many questions. To begin with, these negotiations and the agreements they lead to lack transparency. Typically only a few high-ranking officials are involved and the terms are confidential. Not only are many stakeholders such as farmers not at the table when the agreements are negotiated, they do not even learn about the deals until after they have been signed. And since there is rarely idle productive land in the countries where the land is being purchased or leased, the agreements suggest that many local farmers will simply be displaced. Their land may be confiscated or it may be bought from them at a price over which they have little say. This helps explain the public hostility that often arises within host countries.

China, for example, signed an agreement with the Philippine government to lease over a million hectares of land on which to produce crops that would be shipped home. Once word leaked out, the public outcry—much of it from Filipino farmers—forced the government to suspend the agreement. A similar situation developed in Madagascar, where South Korea's Daewoo Logistics had pursued rights to more than 1 million hectares of land, an area half the size of Belgium. This helped stoke the political furor that led to a change in government and cancellation of the agreement. China is also running into on-the-ground opposition over its quest for 2 million hectares in Zambia.³¹

This new approach to achieving food security also raises questions about the effects on employment. At least two countries, China and South Korea, are planning in some cases to bring in their own farm workers. Beyond this, is the introduction of large-scale commercial, heavily mechanized farming operations what is needed by the recipient countries, where unemployment is widespread?³²

If food prices are rising in the host country, will the investing country actually be able to remove the grain it has produced on acquired land? Or will it have to hire security forces to ensure that the harvests can be brought home? Aware of this potential problem, the government of Pakistan, which is trying to sell or lease 400,000 hectares, is offering to provide a security force of 100,000 men to protect the land and assets of investors. Who will these security forces be protecting the invested assets from?

Will it be hungry Pakistanis? Or perhaps farmers whose land was confiscated to make the massive land sale to the investors?³³

Another disturbing dimension of many land investments is that they are taking place in countries like Indonesia, Brazil, and the Democratic Republic of the Congo where expanding cropland typically means clearing tropical rainforests that sequester large quantities of carbon. This could measurably raise global carbon emissions, increasing the climate threat to world food security.

The Japanese government, IFPRI, and others have suggested the need for an investment code that would govern these land acquisition agreements, a code that would respect the rights of those living in the countries of land acquisition as well as the rights of investors. The World Bank, the U.N. Food and Agriculture Organization, and the African Union are apparently each drafting codes of conduct.³⁴

Growing world food insecurity is thus ushering in a new geopolitics of food scarcity, one where the competition for land and water resources is crossing national boundaries. Many of the land acquisitions are in hunger-ridden, land-scarce countries, leaving less land to produce food for the people who live there. The risk is that this will increase hunger and political instability, leading to even more failing states.

No country is immune to the effects of tightening world food supplies, not even the United States, the world's breadbasket. For example, if China turns to the world market for massive quantities of grain, as it recently has done for soybeans, it will necessarily look to the United States, which dominates world grain exports. For U.S. consumers, the prospect of competing for the U.S. grain harvest with 1.3 billion Chinese consumers with fast-rising incomes is a nightmare scenario.³⁵

In such a situation, it would be tempting for the United States to restrict exports—as it did, for example, with grain and soybeans in the 1970s when domestic food prices soared. But this is not an option with China, which now holds well over \$1 trillion in U.S. debt. It is often the leading international buyer at the monthly auctions of U.S. Treasury securities that finance the growing U.S. fiscal deficit. In effect, China has become banker to the United States. Like it or not, U.S. consumers will share their grain with Chinese consumers, regardless of how high food prices rise.³⁶

Our Global Ponzi Economy

Our mismanaged world economy today has many of the characteristics of a Ponzi scheme. A Ponzi scheme takes payments from a broad base of investors and uses these to pay off returns. It creates the illusion that it is providing a highly attractive rate of return on investment as a result of savvy investment decisions when in fact these irresistibly high earnings are in part the result of consuming the asset base itself. A Ponzi scheme investment fund can last only as long as the flow of new investments is sufficient to sustain the high rates of return paid out to previous investors. When this is no longer possible, the scheme collapses—just as Bernard Madoff’s \$65-billion investment fund did in December 2008.³⁷

Although the functioning of the global economy and a Ponzi investment scheme are not entirely analogous, there are some disturbing parallels. As recently as 1950 or so, the world economy was living more or less within its means, consuming only the sustainable yield, the interest of the natural systems that support it. But then as the economy doubled, and doubled again, and yet again, multiplying eightfold, it began to outrun sustainable yields and to consume the asset base itself. In a 2002 study published by the U.S. National Academy of Sciences, a team of scientists led by Mathis Wackernagel concluded that humanity’s collective demands first surpassed the earth’s regenerative capacity around 1980. As of 2009 global demands on natural systems exceed their sustainable yield capacity by nearly 30 percent. This means we are meeting current demands in part by consuming the earth’s natural assets, setting the stage for an eventual Ponzi-type collapse when these assets are depleted.³⁸

As of mid-2009, nearly all the world’s major aquifers were being overpumped. We have more irrigation water than before the overpumping began, in true Ponzi fashion. We get the feeling that we’re doing very well in agriculture—but the reality is that an estimated 400 million people are today being fed by overpumping, a process that is by definition short-term. With aquifers being depleted, this water-based food bubble is about to burst.³⁹

A similar situation exists with the melting of mountain glaciers. When glaciers first start to melt, flows in the rivers and the irrigation canals they feed are larger than before the melting

started. But after a point, as smaller glaciers disappear and larger ones shrink, the amount of ice melt declines and the river flow diminishes. Thus we have two water-based Ponzi schemes running in parallel in agriculture.

And there are more such schemes. As human and livestock populations grow more or less apace, the rising demand for forage eventually exceeds the sustainable yield of grasslands. As a result, the grass deteriorates, leaving the land bare, allowing it to turn to desert. At some point the herds of ultimately emaciated cattle also collapse. In this Ponzi scheme, herders are forced to rely on food aid or they migrate to cities.

Three fourths of oceanic fisheries are now being fished at or beyond capacity or are recovering from overexploitation. If we continue with business as usual, many of these fisheries will collapse. Overfishing, simply defined, means we are taking fish from the oceans faster than they can reproduce. The cod fishery off the coast of Newfoundland in Canada is a prime example of what can happen. Long one of the world’s most productive fisheries, it collapsed in the early 1990s and may never recover.⁴⁰

Paul Hawken, author of *Blessed Unrest*, puts it well: “At present we are stealing the future, selling it in the present, and calling it gross domestic product. We can just as easily have an economy that is based on healing the future instead of stealing it. We can either create assets for the future or take the assets of the future. One is called restoration and the other exploitation.”⁴¹

The larger question is, If we continue with business as usual—with overpumping, overgrazing, overplowing, overfishing, and overloading the atmosphere with carbon dioxide—how long will it be before the Ponzi economy unravels and collapses? No one knows. Our industrial civilization has not been here before.

Unlike Bernard Madoff’s Ponzi scheme, which was set up with the knowledge that it would eventually fall apart, our global Ponzi economy was not intended to collapse. It is on a collision path because of market forces, perverse incentives, and poorly chosen measures of progress. We rely heavily on the market because it is in so many ways such an incredible institution. It allocates resources with an efficiency that no central planning body can match, and it easily balances supply and demand.

The market does, however, have some fundamental, potentially fatal, weaknesses. It does not respect the sustainable yield

thresholds of natural systems. It also favors the near term over the long term, showing little concern for future generations. It does not incorporate into the prices of goods the indirect costs of producing them. As a result, it cannot provide the signals telling us that we are caught up in a Ponzi scheme.

In addition to consuming our asset base, we have also devised some clever techniques for leaving costs off the books—much like the disgraced and bankrupt Texas-based energy company Enron did some years ago. For example, when we use electricity from a coal-fired power plant we get a monthly bill from the local utility. It includes the cost of mining coal, transporting it to the power plant, burning it, generating the electricity, and delivering electricity to our homes. It does not, however, include any costs of the climate change caused by burning coal. That bill will come later—and it will likely be delivered to our children. Unfortunately for them, their bill for our coal use will be even larger than ours.⁴²

When Sir Nicholas Stern, former chief economist at the World Bank, released his groundbreaking 2006 study on the future costs of climate change, he talked about a massive market failure. He was referring to the failure of the market to incorporate the costs of climate change in the price of fossil fuels. According to Stern, the costs are measured in the trillions of dollars. The difference between the market prices for fossil fuels and an honest price that also incorporates their environmental costs to society is huge.⁴³

As economic decisionmakers—whether consumers, corporate planners, government policymakers, or investment bankers—we all depend on the market for information to guide us. In order for markets to work over the long term and for economic actors to make sound decisions, the markets must provide reliable information, including the full cost of products. But the market is giving us incomplete information, and as a result we are making bad decisions.

One of the best examples of this massive market failure can be seen in the United States, where the gasoline pump price was around \$3 per gallon in mid-2009. This reflects only the cost of finding the oil, pumping it to the surface, refining it into gasoline, and delivering the gas to service stations. It overlooks the costs of climate change as well as the costs of tax subsidies to

the oil industry (such as the U.S. oil depletion allowance), the burgeoning military costs of protecting access to oil in the politically unstable Middle East, and the health care costs of treating respiratory illnesses from breathing polluted air.⁴⁴

Based on a study by the International Center for Technology Assessment, these costs now total nearly \$12 per gallon (\$3.17 per liter) of gasoline burned in the United States. If these were added to the \$3 direct cost of the gasoline, motorists would pay \$15 a gallon for gas at the pump. In reality, burning gasoline is very costly, but the market tells us it is cheap, thus grossly distorting the structure of the economy.⁴⁵

A similar situation exists with food. If we paid the full cost of producing it—including the true cost of the oil used in producing it, the future costs of overpumping aquifers, the destruction of land through erosion, and the carbon dioxide emissions from land clearing—food would cost far more than we now pay for it in the supermarket.

In addition to ignoring indirect costs, the market does not value nature's services. This became abundantly clear in the summer of 1998 when China's Yangtze River valley, home to nearly 400 million people, was wracked by some of the worst flooding in history. The resulting damages of \$30 billion equaled the value of the country's annual rice harvest.⁴⁶

After several weeks of flooding, Beijing announced a ban on tree cutting in the Yangtze River basin. It justified this by noting that trees standing are worth three times as much as trees cut—the flood control services provided by forests were far more valuable than the lumber they contained. In effect, the market price had been off by a factor of three.⁴⁷

The market does not respect the carrying capacity of natural systems. For example, if a fishery is being continuously overfished, the catch eventually will begin to shrink and prices will rise, encouraging even more investment in fishing trawlers. The inevitable result is a precipitous decline in the catch and the collapse of the fishery.

Today we need a realistic view about the relationship between the economy and the environment. We also need, more than ever before, political leaders who can see the big picture. And since the principal advisors to government are economists, we need either economists who can think like ecologists—Sir

Nicholas Stern and Herman Daly, a pioneer in ecological economics, are rare examples of this—or more ecological advisors.

Market behavior—including its failure to include the indirect costs of goods and services, to value nature's services, and to respect sustainable-yield thresholds—is leading to the destruction of the economy's natural support systems, our own version of a Ponzi scheme. At some point the deteriorating relationship between the economy and its natural supports begins to take a political toll, contributing to state failure.

Mounting Stresses, Failing States

After a half-century of forming new states from former colonies and from the breakup of the Soviet Union, the international community is today focusing on the disintegration of states. The term “failing state” has entered our working vocabulary only during the last decade or so, but these countries are now an integral part of the international political landscape. As an article in *Foreign Policy* observes, “Failed states have made a remarkable odyssey from the periphery to the very center of global politics.”⁴⁸

In the past, governments have been concerned by the concentration of too much power in one state, as in Nazi Germany, Imperial Japan, and the Soviet Union. But today it is failing states that provide the greatest threat to global order and stability. As *Foreign Policy* notes, “World leaders once worried about who was amassing power; now they worry about the absence of it.”⁴⁹

States fail when national governments lose control of part or all of their territory and can no longer ensure the personal security of their people. When governments lose their monopoly on power, the rule of law begins to disintegrate. When they can no longer provide basic services such as education, health care, and food security, they lose their legitimacy. A government in this position may no longer be able to collect enough revenue to finance effective governance. Societies can become so fragmented that they lack the cohesion to make decisions.

Failing states often degenerate into civil war as opposing groups vie for power. Conflicts can easily spread to neighboring countries, as when the genocide in Rwanda spilled over into the Democratic Republic of the Congo, where an ongoing civil con-

flict has claimed more than 5 million lives since 1998. The vast majority of these deaths in the Congo are nonviolent, most of them due to hunger, respiratory illnesses, diarrhea, and other diseases as millions have been driven from their homes. Within the Sudan, the killings in Darfur quickly spread into Chad. As *The Economist* observes, “like a severely disturbed individual, a failed state is a danger not just to itself, but to those around it and beyond.”⁵⁰

Failing states can also provide possible training grounds for international terrorist groups, as in Afghanistan, Iraq, and Pakistan, or as a base for pirates, as in Somalia. They may become sources of drugs, as in Myanmar (formerly Burma) or Afghanistan, which accounted for 92 percent of the world's opium supply in 2008, much of which is made into heroin. Because they lack functioning health care services, weakened states can become a source of infectious disease, as Nigeria and Pakistan have for polio, derailing efforts to eradicate this dreaded disease.⁵¹

Among the most conspicuous indications of state failure is a breakdown in law and order and a related loss of personal security. In Haiti, armed gangs ruled the streets until a U.N. peacekeeping force arrived in 2004. While the security situation has improved somewhat since then, kidnappings for ransom of local people who are lucky enough to be among the 30 percent of the labor force that is employed are commonplace. In Afghanistan the local warlords, not the central government, control the country outside of Kabul. Somalia, which now exists only on maps, is ruled by tribal leaders, each claiming a piece of what was once a country. In Mexico, drug cartels are taking over, signaling the prospect of a failed state on the U.S. border.⁵²

Various national and international organizations maintain their own lists of failing, weak, or failed states. The most systematic ongoing effort to analyze failed and failing states is one undertaken jointly by the Fund for Peace and *Foreign Policy* magazine, in an index that is updated annually and published in each July/August issue of *Foreign Policy*. This invaluable service, which draws on thousands of information sources worldwide, is rich with insights into the changes that are under way in the world and, in a broad sense, where the world is heading.⁵³

This analysis identifies 60 countries, ranking them according

to “their vulnerability to violent internal conflict and societal deterioration.” Based on 12 social, economic, political, and military indicators, it puts Somalia at the top of the list of failed states for 2008, followed by Zimbabwe, Sudan, Chad, and the Democratic Republic of the Congo. Three oil-exporting countries are among the top 20 failed states—Sudan, Iraq, and Nigeria. Pakistan, now ranking number 10 on the list, is the only failing state with a nuclear arsenal. North Korea, seventeenth on the list, is developing a nuclear capability. (See Table 1–1.)⁵⁴

Scores for each of the 12 indicators, ranging from 1 to 10, are aggregated into a single country indicator: the Failed States Index. A score of 120, the maximum, means that a society is failing totally by every measure. In the first *Foreign Policy* listing, based on data for 2004, just 7 countries had scores of 100 or more. In 2005 this increased to 9. By 2008 it was 14—doubling in four years. This short trend is far from definitive, but higher scores for countries at the top and the doubling of countries with scores of 100 or higher suggest that state failure is both spreading and deepening.⁵⁵

Ranking on the Failed States Index is closely linked with key demographic and environmental indicators. Of the top 20 failed states, 17 have rapid rates of population growth, several of them expanding at close to 3 percent a year or 20-fold per century. In 5 of these 17 countries, women have on average more than six children each. In all but 6 of the top 20 failed states, at least 40 percent of the population is under 15, a demographic statistic that often signals future political instability. Young men, lacking employment opportunities, often become disaffected, making them ready recruits for insurgency movements.⁵⁶

In many of the countries with several decades of rapid population growth, governments are suffering from demographic fatigue, unable to cope with the steady shrinkage in cropland and freshwater supplies per person or to build schools fast enough for the swelling ranks of children.⁵⁷

Sudan is a classic case of a country caught in the demographic trap. It has developed far enough economically and socially to reduce mortality, but not far enough to quickly reduce fertility. As a result, women on average have four children, double the two needed for replacement, and the population of 41 million is growing by over 2,000 per day. Under this

Table 1–1. *Top 20 Failing States, 2008*

Rank	Country	Score
1	Somalia	114.7
2	Zimbabwe	114.0
3	Sudan	112.4
4	Chad	112.2
5	Democratic Republic of the Congo	108.7
6	Iraq	108.6
7	Afghanistan	108.2
8	Central African Republic	105.4
9	Guinea	104.6
10	Pakistan	104.1
11	Côte d’Ivoire	102.5
12	Haiti	101.8
13	Burma	101.5
14	Kenya	101.4
15	Nigeria	99.8
16	Ethiopia	98.9
17	North Korea	98.3
18	Yemen	98.1
19	Bangladesh	98.1
20	Timor-Leste	97.2

Source: See endnote 54.

pressure, Sudan—like scores of other countries—is breaking down.⁵⁸

All but 3 of the 20 countries that lead the list of failed states are caught in this demographic trap. Realistically, they probably cannot break out of it on their own. They will need outside help—and not just a scattering of aid projects but systemic assistance in rebuilding—or the political situation will simply continue to deteriorate.⁵⁹

Among the top 20 countries on the failing state list, all but a few are losing the race between food production and population growth. Close to half of these states depend on a food lifeline from the WFP.⁶⁰

Food shortages can put intense pressures on governments. In many countries the social order began showing signs of stress in

2007 in the face of soaring food prices and spreading hunger. Food riots and unrest continued in 2008 in dozens of countries—from the tortilla riots in Mexico to breadline fights in Egypt and tempeh protests in Indonesia—and signaled the desperation of consumers trapped between low incomes and rising food prices. In Haiti, soaring food prices helped bring down the government.⁶¹

In Pakistan, where wheat flour prices had doubled, an armed soldier escorted each grain truck lest it be stolen or used to illegally haul scarce wheat across the border into Afghanistan. In Kandahar, Afghanistan, market vendors were robbed at gunpoint by thieves who made off with sacks of grain. In Sudan, 110 grain-laden trucks delivering food for the World Food Programme were hijacked during 2008 before reaching the Darfur relief camps.⁶²

Another characteristic of failing states is a deterioration of the physical infrastructure—roads and power, water, and sewage systems. Care for natural systems is also neglected as people struggle to survive. Forests, grasslands, and croplands deteriorate, generating a downward economic spiral. A drying up of foreign investment and a resultant rise in unemployment are also part of the decline syndrome.

In many countries, the United Nations or other international bodies are trying to keep the peace, often unsuccessfully. Among the countries where U.N. peacekeeping forces are deployed are Chad, the Democratic Republic of the Congo, and Côte d'Ivoire. Other countries supplied with multinational peacekeeping forces include Afghanistan, Haiti, and Sudan. All too often these are token forces, large enough to avoid immediate collapse but not large enough to ensure the stability needed for long-term development.⁶³

Countries like Haiti and Afghanistan are surviving because they are on international life-support systems. Economic assistance, including food lifelines, is helping to sustain them. But there is not enough assistance to overcome the reinforcing trends of deterioration they are experiencing and replace them with the demographic and political stability need to sustain economic progress.⁶⁴

In an age of increasing globalization, the functioning of the global system depends on a cooperative network of functioning

nation states. When governments lose their capacity to govern, they can no longer collect taxes, much less be responsible for their international debts. More failing states means more bad debt. Efforts to control international terrorism depend on cooperation among functioning nation states, and these efforts weaken as more states fail.

In addition, protecting endangered species almost always requires close international cooperation. In countries such as the Democratic Republic of the Congo, where government agencies have collapsed, hunger is widespread, and chaos reigns, the population of mountain gorillas has dropped precipitously. This story is being repeated over and over again in Africa, where so many of the world's remaining large mammal species are concentrated.⁶⁵

As the number of failing states grows, dealing with various international crises becomes more difficult. Actions that may be relatively simple in a healthy world order, such as maintaining monetary stability or controlling an infectious disease outbreak, could become difficult or impossible in a world with numerous disintegrating states. Even maintaining international flows of raw materials could become a challenge. At some point, spreading political instability could disrupt global economic progress, suggesting that we need to address the causes of state failure with a heightened sense of urgency.

Plan B—A Plan to Save Civilization

Plan B is the alternative to business as usual. Its goal is to move the world from the current decline and collapse path onto a new path where food security can be restored and civilization can be sustained. Just as the trends that are behind the current deterioration in the food situation go far beyond agriculture itself, so too must the response. In times past it was the Ministry of Agriculture that held the key to expanding agricultural research, expanding credit to farmers, and all the other obvious things that fall within its province, but securing future food supplies now depends on the mobilization of our entire society.

For these reasons Plan B is far more ambitious than anything the world has ever undertaken, an initiative that has no precedent in either scale or urgency. It has four components: cutting net carbon dioxide emissions 80 percent by 2020, stabilizing

population at 8 billion or lower, eradicating poverty, and restoring the earth's natural systems, including its soils, aquifers, forests, grasslands, and fisheries. The ambitiousness of this plan is not driven by perceived political feasibility but by scientific reality.

The plan to cut carbon emissions involves dramatically raising energy efficiency worldwide, investing in the massive development of the earth's renewable energy resources, banning deforestation, and planting trees by the billion. Plan B essentially outlines a transition from an economy powered mainly by oil, coal, and natural gas to one powered largely by wind, solar, and geothermal energy.

The Plan B goal of stabilizing population is set at 8 billion or lower simply because I do not think world population will ever reach the 9.2 billion projected by U.N. demographers for 2050. To begin with, the vast majority of the 2.4 billion people projected to be added by 2050 will be born in developing countries—countries where the land and water resource base is deteriorating and hunger is spreading. Simply put, many support systems in these countries are already in decline, and some are collapsing. The question is not whether population growth will come to a halt before reaching 9.2 billion but whether it will do so because the world shifts quickly to smaller families or because it fails to do so—and population growth is checked by rising mortality. Plan B embraces the reduced fertility option.⁶⁶

Eradicating poverty is a priority goal for three reasons. One, in combination with giving women everywhere access to reproductive health care and family planning services, it is the key to accelerating the global shift to smaller families. It also helps bring impoverished nations into the international community, giving them a stake in such matters as stabilizing climate. When people are not sure where their next meal is coming from, it is difficult for them to get excited about trying to stabilize the earth's climate. And third, eradicating poverty is the humane thing to do. One of the hallmarks of a civilized society is the capacity to care about others.

The fourth component of Plan B involves repairing and protecting the natural systems that support humankind. This includes conserving soil, banning deforestation, promoting reforestation, restoring fisheries, and making a worldwide effort

to protect aquifers by raising water productivity. Unless we can reverse the deterioration of these systems we are unlikely to reverse the rise in hunger.

Plan B is an integrated program with four interdependent goals. We are not, for example, likely to stabilize population unless we can also eradicate poverty. Conversely, we cannot restore the earth's natural systems without stabilizing population and climate, and we are not likely to stabilize climate unless we also stabilize population. Nor can we eradicate poverty without restoring the earth's natural systems.

The ambitiousness of this save-our-civilization plan is matched by the urgency with which it must be implemented. Success depends on moving at wartime speed, restructuring the world energy economy at a pace reminiscent of the restructuring of the U.S. industrial economy in 1942 following the attack on Pearl Harbor. The United States shifted from producing cars to turning out planes, tanks, and ships within a matter of months. The current restructuring cannot be achieved without a fundamental reordering of priorities. And it will not be accomplished without sacrifice. For example, the key to the 1942 industrial restructuring was a ban on the sale of new cars, a ban that lasted nearly three years.⁶⁷

We face an extraordinary challenge, but there is much to be upbeat about. All the problems we face can be dealt with using existing technologies. And almost everything we need to do to move the world economy off the collapse path and back onto an environmentally sustainable path has already been done in one or more countries. For example, more than 30 countries have essentially stabilized their population size.⁶⁸

We see the components of Plan B in technologies already on the market. On the energy front, for example, we can get more energy from an advanced-design wind turbine than from an aging oil well. The new plug-in gas-electric hybrids coming to market, like the Chevrolet Volt, can get up to 150 miles per gallon. In the Plan B energy economy of 2020, most of the U.S. fleet will be plug-in hybrids and all-electric cars, and they will be running largely on wind-generated electricity for the equivalent of less than \$1 a gallon of gasoline.⁶⁹

The world is in the early stages of a revolution in lighting technology. Some time ago we learned that a compact fluores-

cent could provide the same lighting as the century-old incandescent bulb but would use only one fourth as much electricity. This was exciting news. Now we are looking at a still more-advanced lighting technology—the light-emitting diode (LED)—which uses 15 percent of the electricity used by an incandescent bulb. In addition, motion sensors can turn off lights in unoccupied spaces, and other sensors can adjust lighting intensity in response to the daylight available. Shifting from incandescent bulbs to LEDs and installing motion sensors and dimmers can reduce electricity used for lighting by more than 90 percent.⁷⁰

As for Plan B models at the national level, Denmark today gets more than 20 percent of its electricity from wind and has plans to push this to 50 percent. Seventy-five million Europeans get their residential electricity from wind farms. Some 27 million Chinese homes get their hot water from rooftop solar water heaters. Iceland, which heats 90 percent of its homes with geothermal energy, has virtually eliminated the use of coal for home heating. The Philippines gets 26 percent of its electricity from geothermal power plants.⁷¹

We see what a Plan B world could look like in the reforested mountains of South Korea. Once a barren, almost treeless country, the 65 percent of South Korea now covered by forests has checked flooding and soil erosion, returning environmental health and stability to the Korean countryside. The United States—which over the last quarter-century retired one tenth of its cropland, most of it highly erodible, and shifted to conservation tillage practices on part of the remainder—has reduced soil erosion by 40 percent. Meanwhile, the grain harvest expanded by one fifth.⁷²

Some of the most innovative leadership has come from cities. Curitiba, Brazil, began restructuring its transport system in 1974, and in the two decades that followed the city cut car traffic by 30 percent while its population doubled. Amsterdam has a diverse urban transport system where some 40 percent of all trips within the city are taken by bicycle. And the transport diversification plan in Paris that includes a prominent role for the bicycle is intended to reduce car traffic by 40 percent. London is taxing cars entering the city center and investing the revenue in upgrading public transit.⁷³

The challenge is not only to build a new economy but to do it at wartime speed before we miss so many of nature's deadlines that the economic system begins to unravel. Participating in the construction of this enduring new economy is exhilarating. So is the quality of life it will bring. A world where population has stabilized, forests are expanding, and carbon emissions are falling is within our grasp.

