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The Global Food Crisis

The End of Plenty

By Joel K. Bourne Jr

It is the simplest, most natural of acts, akin to breathing and walking upright. We sit down at the dinner table, pick up a fork, and take a juicy bite, oblivious to the double helping of global ramifications on our plate. Our beef comes from Iowa, fed by Nebraska corn. Our grapes come from Chile, our bananas from Honduras, our olive oil from Sicily, our apple juice—not from Washington State but all the way from China. Modern society has relieved us of the burden of growing, harvesting, even preparing our daily bread, in exchange for the burden of simply paying for it. Only when prices rise do we take notice. And the consequences of our inattention are profound.

Last year the skyrocketing cost of food was a wake-up call for the planet. Between 2005 and the summer of 2008, the price of wheat and corn tripled, and the price of rice climbed fivefold, spurring food riots in nearly two dozen countries and pushing 75 million more people into poverty. But unlike previous shocks driven by short-term food shortages, this price spike came in a year when the world's farmers reaped a record grain crop. This time, the high prices were a symptom of a larger problem tugging at the strands of our worldwide food web, one that's not going away anytime soon. Simply put: For most of the past decade, the world has been consuming more food than it has been producing. After years of drawing down stockpiles, in 2007 the world saw global carryover stocks fall to 61 days of global consumption, the second lowest on record.

"Agricultural productivity growth is only one to two percent a year," warned Joachim von Braun, director general of the International Food Policy Research Institute in Washington, D.C., at the height of the crisis. "This is too low to meet population growth and increased demand."

High prices are the ultimate signal that demand is outstripping supply, that there is simply not enough food to go around. Such agflation hits the poorest billion people on the planet the hardest, since they typically spend 50 to 70 percent of their income on food. Even though prices have fallen with the imploding world economy, they are still near record highs, and the underlying problems of low stockpiles, rising population, and flattening yield growth remain. Climate change—with its hotter growing seasons and increasing water scarcity—is projected to reduce future harvests in much of the world, raising the specter of what some scientists are now calling a perpetual food crisis.

So what is a hot, crowded, and hungry world to do?

That's the question von Braun and his colleagues at the Consultative Group on International Agricultural Research are wrestling with right now. This is the group of world-renowned agricultural research centers that helped more than double the world's average yields of corn, rice, and wheat between the mid-1950s and the mid-1990s, an achievement so staggering it was dubbed the green revolution. Yet with world population spiraling toward nine billion by mid-century, these experts now say we need a repeat performance, doubling current food production by 2030.

In other words, we need another green revolution. And we need it in half the time.

Ever since our ancestors gave up hunting and gathering for plowing and planting some 12,000 years ago, our numbers have marched in lockstep with our agricultural prowess. Each advance—the domestication of animals, irrigation, wet rice production—led to a corresponding jump in human population. Every time food supplies plateaued, population eventually leveled off. Early Arab and Chinese writers noted the relationship between population and food resources, but it wasn't until the end of the 18th century that a British scholar tried to explain the exact mechanism linking the two—and became perhaps the most vilified social scientist in history.

Thomas Robert Malthus, the namesake of such terms as "Malthusian collapse" and "Malthusian curse," was a mild-mannered mathematician, a clergyman—and, his critics would say, the ultimate glass-half-empty kind of guy. When a few Enlightenment philosophers, giddy from the success of the French Revolution, began predicting the continued unfettered improvement of the human condition, Malthus cut them off at the knees. Human population, he observed, increases at a geometric rate, doubling about every 25 years if unchecked, while agricultural production increases arithmetically—much more slowly. Therein lay a biological trap that humanity could never escape.

"The power of population is indefinitely greater than the power in the earth to produce subsistence for man," he wrote in his *Essay on the Principle of Population* in 1798. "This implies a strong and constantly operating check on population from the difficulty of subsistence." Malthus thought such checks could be voluntary, such as birth control, abstinence, or delayed marriage—or involuntary, through the scourges of war, famine, and disease. He advocated against food relief for all but the poorest of people, since he felt such aid encouraged more children to be born into misery. That tough love earned him a nasty cameo in English literature from none other than Charles Dickens. When Ebenezer Scrooge is asked to give alms for the poor in *A Christmas Carol*, the heartless banker tells the do-gooders that the destitute should head for the workhouses or prisons. And if they'd rather die than go there, "they had better do it, and decrease the surplus population."

The industrial revolution and plowing up of the English commons dramatically increased the amount of food in England, sweeping Malthus into the dustbin of the Victorian era. But it was the green revolution that truly made the reverend the laughingstock of modern economists. From 1950 to today the world has experienced the largest population growth in human history. After Malthus's time, six billion people were added to the planet's dinner tables. Yet thanks to improved methods of grain production, most of those people were fed. We'd finally shed Malthusian limits for good.

Or so we thought.

On the 15th night of the ninth month of the Chinese lunar calendar, 3,680 villagers, nearly all with the surname "He," sat beneath a leaking tarp in the square of Yaotian, China, and dived into a 13-course meal. The event was a traditional banquet in honor of their elders. Tureens of steaming soup floated past, followed by rapidly dwindling platters of noodles, rice, fish, shrimp, steamed vegetables, dim sum, duck, chicken, lily root, pigeon, black fungus, and pork cooked more ways than I could count.

Even with the global recession, times are still relatively good in the southeastern province of Guangdong, where Yaotian sits tucked between postage-stamp garden plots and block after block of new factories that helped make the province one of the most prosperous in China. When times are good, the Chinese eat pigs. Lots of pigs. Per capita pork consumption in the world's most populous country went up 45 percent between 1993 and 2005, from 53 to 77 pounds a year.

An affable businessman in a pink-striped polo shirt, pork-industry consultant Shen Guangrong remembers his father raising one pig each year, which was slaughtered at the Chinese New Year. It would be their only meat for the year. The pigs Shen's father raised were pretty low maintenance—hardy black-

and-white varieties that would eat almost anything: food scraps, roots, garbage. Not so China's modern pigs. After the deadly protests of Tiananmen Square in 1989, which topped off a year of political unrest exacerbated by high food prices, the government started offering tax incentives to large industrial farms to meet the growing demand. Shen was assigned to work at one of China's first pig CAFOs, or concentrated animal feeding operations, in nearby Shenzhen. Such farms, which have proliferated in recent years, depend on breeds that are fed high-tech mixtures of corn, soy meal, and supplements to keep them growing fast.

That's good news for the average pork-loving Chinese—who still eats only about 40 percent as much meat as consumers in the U.S. But it's worrisome for the world's grain supplies. It's no coincidence that as countries like China and India prosper and their people move up the food ladder, demand for grain has increased. For as tasty as that sweet-and-sour pork may be, eating meat is an incredibly inefficient way to feed oneself. It takes up to five times more grain to get the equivalent amount of calories from eating pork as from simply eating grain itself—ten times if we're talking about grain-fattened U.S. beef. As more grain has been diverted to livestock and to the production of biofuels for cars, annual worldwide consumption of grain has risen from 815 million metric tons in 1960 to 2.16 billion in 2008. Since 2005, the mad rush to biofuels alone has pushed grain-consumption growth from about 20 million tons annually to 50 million tons, according to Lester Brown of the Earth Policy Institute.

Even China, the second largest corn-growing nation on the planet, can't grow enough grain to feed all its pigs. Most of the shortfall is made up with imported soybeans from the U.S. or Brazil, one of the few countries with the potential to expand its cropland—often by plowing up rain forest. Increasing demand for food, feed, and biofuels has been a major driver of deforestation in the tropics. Between 1980 and 2000 more than half of new cropland acreage in the tropics was carved out of intact rain forests; Brazil alone increased its soybean acreage in Amazonia 10 percent a year from 1990 to 2005.

Some of those Brazilian soybeans may end up in the troughs of Guangzhou Lizhi Farms, the largest CAFO in Guangdong Province. Tucked into a green valley just off a four-lane highway that's still being built, some 60 white hog houses are scattered around large ponds, part of the waste-treatment system for 100,000 hogs. The city of Guangzhou is also building a brand-new meatpacking plant that will slaughter 5,000 head a day. By the time China has 1.5 billion people, sometime in the next 20 years, some experts predict they'll need another 200 million hogs just to keep up. And that's just China. World meat consumption is expected to double by 2050. That means we're going to need a whole lot more grain.

This isn't the first time the world has stood at the brink of a food crisis—it's only the most recent iteration. At 83, Gurcharan Singh Kalkat has lived long enough to remember one of the worst famines of the 20th century. In 1943 as many as four million people died in the "Malthusian correction" known as the Bengal Famine. For the following two decades, India had to import millions of tons of grain to feed its people.

Then came the green revolution. In the mid-1960s, as India was struggling to feed its people during yet another crippling drought, an American plant breeder named Norman Borlaug was working with Indian researchers to bring his high-yielding wheat varieties to Punjab. The new seeds were a godsend, says Kalkat, who was deputy director of agriculture for Punjab at the time. By 1970, farmers had nearly tripled their production with the same amount of work. "We had a big problem with what to do with the surplus," says Kalkat. "We closed schools one month early to store the wheat crop in the buildings."

Borlaug was born in Iowa and saw his mission as spreading the high-yield farming methods that had turned the American Midwest into the world's breadbasket to impoverished places throughout the world. His new dwarf wheat varieties, with their short, stocky stems supporting full, fat seed heads, were a startling breakthrough. They could produce grain like no other wheat ever seen—as long as there was plenty of water and synthetic fertilizer and little competition from weeds or insects. To that end, the Indian government subsidized canals, fertilizer, and the drilling of tube wells for irrigation and gave farmers free electricity to pump the water. The new wheat varieties quickly spread throughout Asia, changing the traditional farming practices of millions of farmers, and were soon followed by new strains of "miracle" rice. The new crops matured faster and enabled farmers to grow two crops a year instead of one. Today a double crop of wheat, rice, or cotton is the norm in Punjab, which, with neighboring Haryana, recently supplied more than 90 percent of the wheat needed by grain-deficient states in India.

The green revolution Borlaug started had nothing to do with the eco-friendly green label in vogue today. With its use of synthetic fertilizers and pesticides to nurture vast fields of the same crop, a practice known as monoculture, this new method of industrial farming was the antithesis of today's organic trend. Rather, William S. Gaud, then administrator of the U.S. Agency for International Development, coined the phrase in 1968 to describe an alternative to Russia's red revolution, in which workers, soldiers, and hungry peasants had rebelled violently against the tsarist government. The more pacifying green revolution was such a staggering success that Borlaug won the Nobel Peace Prize in 1970.

Today, though, the miracle of the green revolution is over in Punjab: Yield growth has essentially flattened since the mid-1990s. Overirrigation has led to steep drops in the water table, now tapped by 1.3 million tube wells, while thousands of hectares of productive land have been lost to salinization and waterlogged soils. Forty years of intensive irrigation, fertilization, and pesticides have not been kind to the loamy gray fields of Punjab. Nor, in some cases, to the people themselves.

In the dusty farming village of Bhuttiwala, home to some 6,000 people in the Muktsar district, village elder Jagsir Singh, in flowing beard and cobalt turban, adds up the toll: "We've had 49 deaths due to cancer in the last four years," he says. "Most of them were young people. The water is not good. It's poisonous,

contaminated water. Yet people still drink it."

Walking through the narrow dirt lanes past pyramids of dried cow dung, Singh introduces Amarjeet Kaur, a slender 40-year-old who for years drew the family's daily water from a hand pump in their brick-hard compound. She was diagnosed with breast cancer last year. Tej Kaur, 50, also has breast cancer. Her surgery, she says, wasn't nearly as painful as losing her seven-year-old grandson to "blood cancer," or leukemia. Jagdev Singh is a sweet-faced 14-year-old boy whose spine is slowly deteriorating. From his wheelchair, he is watching *SpongeBob SquarePants* dubbed in Hindi as his father discusses his prognosis. "The doctors say he will not live to see 20," says Bhola Singh.

There's no proof these cancers were caused by pesticides. But researchers have found pesticides in the Punjabi farmers' blood, their water table, their vegetables, even their wives' breast milk. So many people take the train from the Malwa region to the cancer hospital in Bikaner that it's now called the Cancer Express. The government is concerned enough to spend millions on reverse-osmosis water-treatment plants for the worst affected villages.

If that weren't worrisome enough, the high cost of fertilizers and pesticides has plunged many Punjabi farmers into debt. One study found more than 1,400 cases of farmer suicides in 93 villages between 1988 and 2006. Some groups put the total for the state as high as 40,000 to 60,000 suicides over that period. Many drank pesticides or hung themselves in their fields.

"The green revolution has brought us only downfall," says Jarnail Singh, a retired schoolteacher in Jajjal village. "It ruined our soil, our environment, our water table. Used to be we had fairs in villages where people would come together and have fun. Now we gather in medical centers. The government has sacrificed the people of Punjab for grain."

Others, of course, see it differently. Rattan Lal, a noted soil scientist at Ohio State who graduated from Punjab Agricultural University in 1963, believes it was the abuse—not the use—of green revolution technologies that caused most of the problems. That includes the overuse of fertilizers, pesticides, and irrigation and the removal of all crop residues from the fields, essentially strip-mining soil nutrients. "I realize the problems of water quality and water withdrawal," says Lal. "But it saved hundreds of millions of people. We paid a price in water, but the choice was to let people die."

In terms of production, the benefits of the green revolution are hard to deny. India hasn't experienced famine since Borlaug brought his seeds to town, while world grain production has more than doubled. Some scientists credit increased rice yields alone with the existence of 700 million more people on the

planet.

Many crop scientists and farmers believe the solution to our current food crisis lies in a second green revolution, based largely on our newfound knowledge of the gene. Plant breeders now know the sequence of nearly all of the 50,000 or so genes in corn and soybean plants and are using that knowledge in ways that were unimaginable only four or five years ago, says Robert Fraley, chief technology officer for the agricultural giant Monsanto. Fraley is convinced that genetic modification, which allows breeders to bolster crops with beneficial traits from other species, will lead to new varieties with higher yields, reduced fertilizer needs, and drought tolerance—the holy grail for the past decade. He believes biotech will make it possible to double yields of Monsanto's core crops of corn, cotton, and soybeans by 2030. "We're now poised to see probably the greatest period of fundamental scientific advance in the history of agriculture."

Africa is the continent where *Homo sapiens* was born, and with its worn-out soils, fitful rain, and rising population, it could very well offer a glimpse of our species' future. For numerous reasons—lack of infrastructure, corruption, inaccessible markets—the green revolution never made it here. Agricultural production per capita actually declined in sub-Saharan Africa between 1970 and 2000, while the population soared, leaving an average ten-million-ton annual food deficit. It's now home to more than a quarter of the world's hungriest people.

Tiny, landlocked Malawi, dubbed the "warm heart of Africa" by a hopeful tourism industry, is also in the hungry heart of Africa, a poster child for the continent's agricultural ills. Living in one of the poorest and most densely populated countries in Africa, the majority of Malawians are corn farmers who eke out a living on less than two dollars a day. In 2005 the rains failed once again in Malawi, and more than a third of its population of 13 million required food aid to survive. Malawi's President Bingu wa Mutharika declared he did not get elected to rule a nation of beggars. After initially failing to persuade the World Bank and other donors to help subsidize green revolution inputs, Bingu, as he's known here, decided to spend \$58 million from the country's own coffers to get hybrid seeds and fertilizers into the hands of poor farmers. The World Bank eventually got on board and persuaded Bingu to target the subsidy to the poorest farmers. About 1.3 million farm families received coupons that allowed them to buy three kilograms of hybrid corn seed and two 50-kilogram bags of fertilizer at a third of the market price.

What happened next has been called the Malawi Miracle. Good seed and a little fertilizer—and the return of soil-soaking rains—helped farmers reap bumper crops for the next two years. (Last year's harvests, however, were slightly down.) The 2007 harvest was estimated to be 3.44 million metric tons, a national record. "They went from a 44 percent deficit to an 18 percent surplus, doubling their production," says Pedro Sanchez, the director of the Tropical Agriculture Program at Columbia University who advised the Malawi government on the program. "The next year they had a 53 percent surplus and exported maize to Zimbabwe. It was a dramatic change."

So dramatic, in fact, that it has led to an increasing awareness of the importance of agricultural investment in reducing poverty and hunger in places like Malawi. In October 2007 the World Bank issued a critical report, concluding that the agency, international donors, and African governments had fallen short in helping Africa's poor farmers and had neglected investment in agriculture for the previous 15 years. After decades of discouraging public investment in agriculture and calling for market-based solutions that rarely materialized, institutions like the World Bank have reversed course and pumped funds into agriculture over the past two years.

Malawi's subsidy program is part of a larger movement to bring the green revolution, at long last, to Africa. Since 2006 the Rockefeller Foundation and the Bill and Melinda Gates Foundation have ponied up nearly half a billion dollars to fund the Alliance for a Green Revolution in Africa, focused primarily on bringing plant-breeding programs to African universities and enough fertilizer to farmers' fields. Columbia's Sanchez, along with über-economist and poverty warrior Jeffrey Sachs, is providing concrete examples of the benefits of such investment in 80 small villages clustered into about a dozen "Millennium Villages" scattered in hunger hot spots throughout Africa. With the help of a few rock stars and A-list actors, Sanchez and Sachs are spending \$300,000 a year on each small village. That's one-third as much per person as Malawi's per capita GDP, leading many in the development community to wonder if such a program can be sustained over the long haul.

Phelire Nkhoma, a small whipcord of a woman, is the agricultural extension officer for one of Malawi's two Millennium Villages—actually seven villages with a total of 35,000 people. She describes the program as we ride in a new UN pickup from her office in Zomba District through fire-blackened fields dotted with the violet flush of jacaranda trees. Villagers get hybrid seeds and fertilizers for free—as long as they donate three bags of corn at harvesttime to a school feeding program. They get bed nets and antimalarial drugs. They get a clinic staffed with health workers, a granary to store their harvests, and safe-drinking-water wells within a kilometer of each household. Good primary schools, improved road systems, and connection to the power grid and the Internet are on the way in these villages, and in the "Madonna" village, which is farther north.

"The Madonna?" I asked.

"Yes. I hear she's divorcing her latest husband. Is that true?"

Good times are apparent in the Millennium Village, where Nkhoma shows me new brick houses topped with shiny corrugated-steel roofs, a grain bank full of seed and fertilizer, and beneath a shade tree, a hundred or more villagers patiently listening to a banker explaining how they can apply for an agricultural

loan. Several are queued up at the teller window of an armored truck from Opportunity International Bank of Malawi. Cosmas Chimwara, a 30-year-old cabbage seller, is one of them. "The cabbage business is going well," he says. "I have three bikes, a TV and mobile phone, and a better house."

Such stories warm the heart of Faison Tipoti, the village leader who was instrumental in bringing the famous project here. "When Jeff Sachs came and asked, 'What do you want?' we said not money, not flour, but give us fertilizer and hybrid seed, and he will do a good thing," says Tipoti in a deep voice. No longer do villagers spend their days walking the road begging others for food to feed children with swollen bellies and sickness. He gazes over to where several children are frolicking as they wash clothes and gather water at the new village well. "With the coming of the project, everywhere is clear, fresh water," Tipoti says.

But is a reprise of the green revolution—with the traditional package of synthetic fertilizers, pesticides, and irrigation, supercharged by genetically engineered seeds—really the answer to the world's food crisis? Last year a massive study called the "International Assessment of Agricultural Knowledge, Science and Technology for Development" concluded that the immense production increases brought about by science and technology in the past 30 years have failed to improve food access for many of the world's poor. The six-year study, initiated by the World Bank and the UN's Food and Agriculture Organization and involving some 400 agricultural experts from around the globe, called for a paradigm shift in agriculture toward more sustainable and ecologically friendly practices that would benefit the world's 900 million small farmers, not just agribusiness.

The green revolution's legacy of tainted soil and depleted aquifers is one reason to look for new strategies. So is what author and University of California, Berkeley, professor Michael Pollan calls the Achilles heel of current green revolution methods: a dependence on fossil fuels. Natural gas, for example, is a raw material for nitrogen fertilizers. "The only way you can have one farmer feed 140 Americans is with monocultures. And monocultures need lots of fossil-fuel-based fertilizers and lots of fossil-fuel-based pesticides," Pollan says. "That only works in an era of cheap fossil fuels, and that era is coming to an end. Moving anyone to a dependence on fossil fuels seems the height of irresponsibility."

So far, genetic breakthroughs that would free green revolution crops from their heavy dependence on irrigation and fertilizer have proved elusive. Engineering plants that can fix their own nitrogen or are resistant to drought "has proven a lot harder than they thought," says Pollan. Monsanto's Fraley predicts his company will have drought-tolerant corn in the U.S. market by 2012. But the increased yields promised during drought years are only 6 to 10 percent above those of standard drought-hammered crops.

And so a shift has already begun to small, underfunded projects scattered across Africa and Asia. Some call it agroecology, others sustainable agriculture, but

the underlying idea is revolutionary: that we must stop focusing on simply maximizing grain yields at any cost and consider the environmental and social impacts of food production. Vandana Shiva is a nuclear physicist turned agroecologist who is India's harshest critic of the green revolution. "I call it monocultures of the mind," she says. "They just look at yields of wheat and rice, but overall the food basket is going down. There were 250 kinds of crops in Punjab before the green revolution." Shiva argues that small-scale, biologically diverse farms can produce more food with fewer petroleum-based inputs. Her research has shown that using compost instead of natural-gas-derived fertilizer increases organic matter in the soil, sequestering carbon and holding moisture—two key advantages for farmers facing climate change. "If you are talking about solving the food crisis, these are the methods you need," adds Shiva.

In northern Malawi one project is getting many of the same results as the Millennium Villages project, at a fraction of the cost. There are no hybrid corn seeds, free fertilizers, or new roads here in the village of Ekwendeni. Instead the Soils, Food and Healthy Communities (SFHC) project distributes legume seeds, recipes, and technical advice for growing nutritious crops like peanuts, pigeon peas, and soybeans, which enrich the soil by fixing nitrogen while also enriching children's diets. The program began in 2000 at Ekwendeni Hospital, where the staff was seeing high rates of malnutrition. Research suggested the culprit was the corn monoculture that had left small farmers with poor yields due to depleted soils and the high price of fertilizer.

The project's old pickup needs a push to get it going, but soon Boyd Zimba, the project's assistant coordinator, and Zacharia Nkhonya, its food-security supervisor, are rattling down the road, talking about what they see as the downside of the Malawi Miracle. "First, the fertilizer subsidy cannot last long," says Nkhonya, a compact man with a quick smile. "Second, it doesn't go to everyone. And third, it only comes once a year, while legumes are long-term—soils get improved every year, unlike with fertilizers."

At the small village of Encongolweni, a group of two dozen SFHC farmers greet us with a song about the dishes they make from soybeans and pigeon peas. We sit in their meetinghouse as if at an old-time tent revival, as they testify about how planting legumes has changed their lives. Ackim Mhone's story is typical. By incorporating legumes into his rotation, he's doubled his corn yield on his small plot of land while cutting his fertilizer use in half. "That was enough to change the life of my family," Mhone says, and to enable him to improve his house and buy livestock. Later, Alice Sumphi, a 67-year-old farmer with a mischievous smile, dances in her plot of young knee-high tomatoes, proudly pointing out that they bested those of the younger men. Canadian researchers found that after eight years, the children of more than 7,000 families involved in the project showed significant weight increases, making a pretty good case that soil health and community health are connected in Malawi.

Which is why the project's research coordinator, Rachel Bezner Kerr, is alarmed that big-money foundations are pushing for a new green revolution in

Africa. "I find it deeply disturbing," she says. "It's getting farmers to rely on expensive inputs produced from afar that are making money for big companies rather than on agroecological methods for using local resources and skills. I don't think that's the solution."

Regardless of which model prevails—agriculture as a diverse ecological art, as a high-tech industry, or some combination of the two—the challenge of putting enough food in nine billion mouths by 2050 is daunting. Two billion people already live in the driest parts of the globe, and climate change is projected to slash yields in these regions even further. No matter how great their yield potential, plants still need water to grow. And in the not too distant future, every year could be a drought year for much of the globe.

New climate studies show that extreme heat waves, such as the one that withered crops and killed thousands in western Europe in 2003, are very likely to become common in the tropics and subtropics by century's end. Himalayan glaciers that now provide water for hundreds of millions of people, livestock, and farmland in China and India are melting faster and could vanish completely by 2035. In the worst-case scenario, yields for some grains could decline by 10 to 15 percent in South Asia by 2030. Projections for southern Africa are even more dire. In a region already racked by water scarcity and food insecurity, the all-important corn harvest could drop by 30 percent—47 percent in the worst-case scenario. All the while the population clock keeps ticking, with a net of 2.5 more mouths to feed born every second. That amounts to 4,500 more mouths in the time it takes you to read this article.

Which leads us, inevitably, back to Malthus.

On a brisk fall day that has put color into the cheeks of the most die-hard Londoners, I visit the British Library and check out the first edition of the book that still generates such heated debate. Malthus's *Essay on the Principle of Population* looks like an eighth-grade science primer. From its strong, clear prose comes the voice of a humble parish priest who hoped, as much as anything, to be proved wrong.

"People who say Malthus is wrong usually haven't read him," says Tim Dyson, a professor of population studies at the London School of Economics. "He was not taking a view any different than what Adam Smith took in the first volume of *The Wealth of Nations*. No one in their right mind doubts the idea that populations have to live within their resource base. And that the capacity of society to increase resources from that base is ultimately limited."

Though his essays emphasized "positive checks" on population from famine, disease, and war, his "preventative checks" may have been more important. A growing workforce, Malthus explained, depresses wages, which tends to make people delay marriage until they can better support a family. Delaying

marriage reduces fertility rates, creating an equally powerful check on populations. It has now been shown that this is the basic mechanism that regulated population growth in western Europe for some 300 years before the industrial revolution—a pretty good record for *any* social scientist, says Dyson.

Yet when Britain recently issued a new 20-pound note, it put Adam Smith on the back, not T. R. Malthus. He doesn't fit the ethos of the moment. We don't want to think about limits. But as we approach nine billion people on the planet, all clamoring for the same opportunities, the same lifestyles, the same hamburgers, we ignore them at our risk.

None of the great classical economists saw the industrial revolution coming, or the transformation of economies and agriculture that it would bring about. The cheap, readily available energy contained in coal—and later in other fossil fuels—unleashed the greatest increase in food, personal wealth, and people the world has ever seen, enabling Earth's population to increase sevenfold since Malthus's day. And yet hunger, famine, and malnutrition are with us still, just as Malthus said they would be.

"Years ago I was working with a Chinese demographer," Dyson says. "One day he pointed out to me the two Chinese characters above his office door that spelled the word 'population.' You had the character for a person and the character for an open mouth. It really struck me. Ultimately there has to be a balance between population and resources. And this notion that we can continue to grow forever, well it's ridiculous."

Perhaps somewhere deep in his crypt in Bath Abbey, Malthus is quietly wagging a bony finger and saying, "Told you so."

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