Des Moines River. In spring, when nitrogen runoff is at its heaviest, the city issues "blue baby alerts," warning parents it's unsafe to give children water from the tap. The nitrates in the water bind to hemoglobin, compromising the blood's ability to carry oxygen to the brain. So I guess I was wrong to suggest we don't sip fossil fuels directly; sometimes we do.

It has been less than a century since Fritz Haber's invention, yet already it has changed earth's ecology. More than half of the world's supply of usable nitrogen is now man-made. (Unless you grew up on organic food, most of the kilo or so of nitrogen in your body was fixed by the Haber-Bosch process.) "We have perturbed the global nitrogen cycle," Smil wrote, "more than any other, even carbon." The effects may be harder to predict than the effects of the global warming caused by our disturbance of the carbon cycle, but they may be no less momentous. The flood of synthetic nitrogen has fertilized not just the farm fields but the forests and the oceans too, to the benefit of some species (corn and algae being two of the biggest beneficiaries), and to the detriment of countless others. The ultimate fate of the nitrates that George Naylor spreads on his cornfield in Iowa is to flow down the Mississippi into the Gulf of Mexico, where their deadly fertility poisons the marine ecosystem. The nitrogen tide stimulates the wild growth of algae, and the algae smother the fish, creating a "hypoxic," or dead, zone as big as the state of New Jersey—and still growing. By fertilizing the world, we alter the planet's composition of species and shrink its biodiversity.

5. A PLAGUE OF CHEAP CORN

The day after George Naylor and I finished planting his corn, the rains came, so we spent most of it around his kitchen table, drinking coffee and talking about what farmers always talk about: lousy commodity prices; benighted farm policies; making ends meet in a dysfunctional farm economy. Naylor came back to the farm at what would turn out to be the good old days in American agriculture: Corn prices were at an

all-time high, and it looked as though it might actually be possible to make a living growing it. But by the time Naylor was ready to take his first crop to the elevator, the price of a bushel of corn had dropped from three dollars to two dollars, the result of a bumper crop. So he held his corn off the market, storing it in the hope that the price would rebound. But the price kept falling all through that winter and into the following spring and, if you factor in inflation, it has pretty much been falling ever since. These days the price of a bushel of corn is about a dollar beneath the true cost of growing it, a boon for everyone but the corn farmer. What I was hoping George Naylor could help me understand is, if there's so much corn being grown in America today that the market won't pay the cost of producing it, then why would any farmer in his right mind plant another acre of it?

The answer is complicated, as I would learn, but it has something to do with the perverse economics of agriculture, which would seem to defy the classical laws of supply and demand; a little to do with the psychology of farmers; and everything to do with farm policies, which underwent a revolution right around the time George Naylor was buying his first tractor. Government farm programs once designed to limit production and support prices (and therefore farmers) were quietly rejiggered to increase production and drive down prices. Put another way, instead of supporting farmers, during the Nixon administration the government began supporting corn at the expense of farmers. Corn, already the recipient of a biological subsidy in the form of synthetic nitrogen, would now receive an economic subsidy too, insuring its final triumph over the land and the food system.

NAYLOR'S PERSPECTIVE on farm policy was shaped by a story his dad used to tell him. It takes place during the winter of 1933, in the depths of the farm depression. "That's when my father hauled corn to town and found out that the price of corn had been ten cents a bushel the day before, but on that day the elevator wasn't even buying." The price of corn had fallen to zero. "Tears always came to his eyes when he re-

counted the neighbors losing their farms in the 1920s and '30s," Naylor told me. America's farm policy was forged during the Depression not, as many people seem to think, to encourage farmers to produce more food for a hungry nation, but to rescue farmers from the disastrous effects of growing too much food—far more than Americans could afford to buy.

For as long as people have been farming, fat years have posed almost as stiff a challenge as lean, since crop surpluses collapse prices and bankrupt farmers who will be needed again when the inevitable lean years return. When it comes to food, nature can make a mockery of the classical economics of supply and demand—nature in the form of good or bad weather, of course, but also the nature of the human body, which can consume only so much food no matter how plentiful the supply. So, going back to the Old Testament, communities have devised various strategies to even out the destructive swings of agricultural production. The Bible's recommended farm policy was to establish a grain reserve. Not only did this insure that when drought or pestilence ruined a harvest there'd still be food to eat, but it kept farmers whole by taking food off the market when the harvest was bountiful.

This is more or less what New Deal farm programs attempted to do. For storable commodities such as corn, the government established a target price based on the cost of production, and whenever the market price dropped below that target, the farmer was given a choice. Instead of dumping corn onto a weak market (thereby weakening it further), the farmer could take out a loan from the government—using his crop as collateral—that allowed him to store his grain until prices recovered. At that point, he sold the corn and paid back the loan; if corn prices stayed low, he could elect to keep the money he'd borrowed and, in repayment, give the government his corn, which would then go into something that came to be called, rather quaintly, the "Ever-Normal Granary." Other New Deal programs, such as those administered by the Soil Conservation Service, sought to avert overproduction (and soil erosion) by encouraging farmers to idle their most environmentally sensitive land.

The system, which remained in place more or less until shortly before George Naylor came back to the farm in the 1970s, did a fairly good job of keeping corn prices from collapsing in the face of the twentieth century's rapid gains in yield. Surpluses were held off the market by the offer of these "nonrecourse loans," which cost the government relatively little, since most of the loans were eventually repaid. And when prices climbed, as a result of bad weather, say, the government sold corn from its granary, which helped both to pay for the farm programs and smooth out the inevitable swings in price.

I say this system remained in place "more or less" until the 1970s because, beginning in the 1950s, a campaign to dismantle the New Deal farm programs took root, and with every new farm bill since then another strut was removed from the structure of support. Almost from the start, the policy of supporting prices and limiting production had collected powerful enemies: exponents of laissez-faire economics, who didn't see why farming should be treated differently than any other economic sector; food processors and grain exporters, who profited from overproduction and low crop prices; and a coalition of political and business leaders who for various reasons thought America had far too many farmers for her (or at least their) own good.

America's farmers had long been making political trouble for Wall Street and Washington; in the words of historian Walter Karp, "since the Civil War at least, the most unruly, the most independent, the most republican of American citizens have been the small farmers." Beginning with the populist revolt of the 1890s, farmers had made common cause with the labor movement, working together to check the power of corporations. Rising agricultural productivity handed a golden opportunity to the farmers' traditional adversaries. Since a smaller number of farmers could now feed America, the moment had come to "rationalize" agriculture by letting the market force prices down and farmers off the land. So Wall Street and Washington sought changes in farm policies that would loose "a plague of cheap corn" (in the words of George Naylor, a man very much in the old rural-populist mold) on the nation, the effects of which are all around us—indeed, in us.

6. THE SAGE OF PURDUE

Earl "Rusty" Butz, Richard Nixon's second secretary of agriculture, probably did more than any other single individual to orchestrate George Naylor's plague of cheap corn. In every newspaper article about him, and there were scores, the name of Earl Butz, a blustering, highly quotable agricultural economist from Purdue University, is invariably accompanied by the epithet "colorful." Butz's plainspoken manner and barnyard humor persuaded many people he must be a friend to the farmer, but his presence on the board of Ralston Purina probably offered a more reliable guide to his sympathies. Though chiefly remembered outside agriculture for the racist joke that cost him his job during the 1976 election, Butz revolutionized American agriculture, helping to shift the food chain onto a foundation of cheap corn.

Butz took over the Department of Agriculture during the last period in American history that food prices climbed high enough to generate real political heat; his legacy would be to make sure that never happened again. In the fall of 1972 Russia, having suffered a series of disastrous harvests, purchased 30 million tons of American grain. Butz had helped arrange the sale, in the hopes of giving a boost to crop prices in order to bring restive farmers tempted to vote for George McGovern into the Republican fold. The plan worked all too well: The unexpected surge in demand, coinciding with a spell of bad weather in the Farm Belt, drove grain prices to historic heights. These were the corn prices that persuaded George Naylor he could make a go of it on his family's farm.

The 1972 Russian grain sale and the resulting spike in farm income that fall helped Nixon nail down the farm vote for his reelection, but by the following year those prices had reverberated through the food chain, all the way to the supermarket. By 1973 the inflation rate for groceries reached an all-time high, and housewives were organizing protests at supermarkets. Farmers were killing chicks because they couldn't afford to buy feed, and the price of beef was slipping beyond the reach of middle-class consumers. Some foods became scarce; horse

meat began showing up in certain markets. "Why a Food Scare in a Land of Plenty?" was a headline in *U.S. News and World Report* that summer. Nixon had a consumer revolt on his hands, and he dispatched Earl Butz to quell it. The Sage of Purdue set to work reengineering the American food system, driving down prices and vastly increasing the output of American farmers. What had long been the dream of agribusiness (cheaper raw materials) and the political establishment (fewer restive farmers) now became official government policy.

Butz made no secret of his agenda: He exhorted farmers to plant their fields "fencerow to fencerow" and advised them to "get big or get out." Bigger farms were more productive, he believed, so he pushed farmers to consolidate ("adapt or die" was another of his credos) and to regard themselves not as farmers but as "agribusinessmen." Somewhat less noisily, Butz set to work dismantling the New Deal farm regime of price supports, a job made easier by the fact that prices at the time were so high. He abolished the Ever-Normal Granary and, with the 1973 farm bill, began replacing the New Deal system of supporting prices through loans, government grain purchases, and land idling with a new system of direct payments to farmers.

The change from loans to direct payments hardly seems momentous—either way, the government pledged to make sure the farmer receives some target price for a bushel of corn when prices are weak. But in fact paying farmers directly for the shortfall in the price of corn was revolutionary, as its proponents surely must have understood. They had removed the floor under the price of grain. Instead of keeping corn out of a falling market, as the old loan programs and federal granary had done, the new subsidies encouraged farmers to sell their corn at any price, since the government would make up the difference. Or, as it turned out, make up *some* of the difference, since just about every farm bill since has lowered the target price in order, it was claimed, to make American grain more competitive in world markets. (Beginning in the 1980s, big buyers of grain like Cargill and Archer Daniels Midland (ADM) took a hand in shaping the farm bills, which predictably came to reflect their interests more closely than those of

farmers.) Instead of supporting farmers, the government was now subsidizing every bushel of corn a farmer could grow—and American farmers pushed to go flat out could grow a hell of a lot of corn.

7. THE NAYLOR CURVE

It's not at all clear that very many American farmers know exactly what hit them, even now. The rhetoric of competitiveness and free trade persuaded many of them that cheap corn would be their salvation, and several putative farmers' organizations have bought into the virtues of cheap corn. But since the heyday of corn prices in the early seventies, farm income has steadily declined along with corn prices, forcing millions of farmers deeper into debt and thousands of them into bankruptcy every week. Exports, as a percentage of the American corn harvest, have barely budged from around 20 percent, even as prices have fallen. Iowa State University estimates that it costs roughly $2.50 to grow a bushel of Iowa corn; in October 2005 Iowa grain elevators were paying $1.45, so the typical Iowa farmer is selling corn for a dollar less than it costs him to grow it. Yet the corn keeps coming, more of it every year.

How can this possibly be?

George Naylor has studied this question, and he has come up with a convincing answer. He's often asked to speak at meetings on the farm crisis, and to testify at hearings about farm policy, where he often presents a graph he's drawn to explain the mystery. He calls it the Naylor Curve. ("Remember the Laffer curve? Well, this one looks a little like that one, only it's true.") Basically it purports to show why falling farm prices force farmers to increase production in defiance of all rational economic behavior.

"Farmers facing lower prices have only one option if they want to be able to maintain their standard of living, pay their bills, and service their debt, and that is to produce more." A farm family needs a certain amount of cash flow every year to support itself, and if the price of corn

falls, the only way to stay even is to sell more corn. Naylor says that farmers desperate to boost yield end up degrading their land, plowing and planting marginal land, applying more nitrogen—anything to squeeze a few more bushels from the soil. Yet the more bushels each farmer produces, the lower prices go, giving another turn to the perverse spiral of overproduction. Even so, corn farmers persist in measuring their success in bushels per acre, a measurement that improves even as they go broke.

"The free market has never worked in agriculture and it never will. The economics of a family farm are very different than a firm's: When prices fall, the firm can lay off people, idle factories, and make fewer widgets. Eventually the market finds a new balance between supply and demand. But the demand for food isn't elastic; people don't eat more just because food is cheap. And laying off farmers doesn't help to reduce supply. You can fire me, but you can't fire my land, because some other farmer who needs more cash flow or thinks he's more efficient than I am will come in and farm it. Even if I go out of business this land will keep producing corn."

But why corn and not something else? "We're on the bottom rung of the industrial food chain here, using this land to produce energy and protein, mostly to feed animals. Corn is the most efficient way to produce energy, soybeans the most efficient way to produce protein." The notion of switching to some other crop Naylor gruffly dismisses. "What am I going to grow here, broccoli? Lettuce? We've got a long-term investment in growing corn and soybeans; the elevator is the only buyer in town, and the elevator only pays me for corn and soybeans. The market is telling me to grow corn and soybeans, period." As is the government, which calculates his various subsidy payments based on his yield of corn.

So the plague of cheap corn goes on, impoverishing farmers (both here and in the countries to which we export it), degrading the land, polluting the water, and bleeding the federal treasury, which now spends up to $5 billion a year subsidizing cheap corn. But though those subsidy checks go to the farmer (and represents nearly half of net farm

income today), what the Treasury is really subsidizing are the buyers of all that cheap corn. "Agriculture's always going to be organized by the government; the question is, organized for whose benefit? Now it's for Cargill and Coca-Cola. It's certainly not for the farmer."

Early that afternoon, after George and I had been talking agricultural policy for longer than I ever thought possible, the phone rang; his neighbor, Billy, needed a hand with a balky corn planter. On the drive over Naylor told me a little about Billy. "He's got all the latest toys: the twelve-row planter, Roundup Ready seed, the new John Deere combine." George rolled his eyes. "Billy's in debt up to his eyeballs." George believes he's managed to survive on the farm by steering clear of debt, nursing along his antique combine and tractor, and avoiding the trap of expansion.

A blockish fellow in his fifties, with a seed cap perched over a graying crew cut, Billy seemed cheerful enough, especially considering he'd just blown his morning fiddling with a broken tractor cable. While he and George were working on it I checked out the shed full of state-of-the-art farm equipment and asked him what he thought about the Bt corn he was planting—corn genetically engineered to produce its own pesticide. Billy thought the seed was the greatest. "I'm getting 220 bushels an acre on that seed," he boasted. "How's that compare, George?"

George owned he was getting something just south of two hundred, but he was too polite to say what he knew, which was that he was almost certainly clearing more money per acre growing less corn more cheaply. But in Iowa, bragging rights go to the man with the biggest yield, even if it's bankrupting him.

In a shed across the way I noticed the shiny chrome prow of a tractor trailer poking out and asked Billy about it. He explained he'd had to take on long-distance hauling work to keep the farm afloat. "Have to drive the big rig to pay for all my farm toys," he chuckled.

George tossed me a look, as if to say, kind of pathetic, isn't it? Poignant seemed more like it, to think what this farmer had to do to hold on to his farm. I was reminded of Thoreau's line: "Men have be-

come the tools of their tools." And I wondered if Billy gave much thought, in those late-night hours rolling up the miles on Interstate 80, to how he got to this point, and about who he was really working for now. The bank? John Deere? Monsanto? Pioneer? Cargill? Two hundred and twenty bushels of corn is an astounding accomplishment, yet it didn't do Billy nearly as much good as it did those companies.

And then of course there's the corn itself, which if corn could form an opinion would surely marvel at the absurdity of it all—and at its great good fortune. For corn has been exempted from the usual rules of nature and economics, both of which have rough mechanisms to check any such wild, uncontrolled proliferation. In nature, the population of a species explodes until it exhausts its supply of food; then it crashes. In the market, an oversupply of a commodity depresses prices until the surplus is either consumed or it no longer makes sense to produce any more of it. In corn's case, humans have labored mightily to free it from either constraint, even if that means going broke growing it, and consuming it just as fast as we possibly can.