

The End of Pasta

A world without pasta seems inconceivable. Mac-and-cheese-loving children across the United States would howl in protest. Italy might suffer a cultural heart attack. Social unrest could explode in northern China, where noodles are the main staple.



Wheat stands to fare the worst in the years ahead, for it is the grain most vulnerable to high temperatures. (Ryan Mcvay / Iconica-Getty Images)

But if humans want to keep eating pasta, we will have to take much more aggressive action against global warming. Pasta is made from wheat, and a large, growing body of scientific studies and real-world observations suggest that wheat will be hit especially hard as temperatures rise and storms and drought intensify in the years ahead.

Hurricane Sandy's recent devastation of New York and neighboring states reminded Americans of what Hurricane Katrina demonstrated

A promotional graphic for a Newsweek special issue. On the left is a tablet displaying the cover of the special issue, which features a collage of presidential portraits and the text 'THE 10 BEST AMERICAN PRESIDENTS'. To the right of the tablet, the text reads: 'Newsweek SPECIAL ISSUE THE 10 BEST AMERICAN PRESIDENTS ONLY 99 CENTS FOR A LIMITED TIME DOWNLOAD IT NOW'.

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in 2005: global warming makes weather more extreme, and extreme weather can be extremely dangerous. But flooding coastlines aren't our only worry. Climate change is also imperiling the very foundation of human existence: our ability to feed ourselves.

Three grains—wheat, corn, and rice—account for most of the food humans consume. All three are already suffering from climate change, but wheat stands to fare the worst in the years ahead, for it is the grain most vulnerable to high temperatures. That spells trouble not only for pasta but also for bread, the most basic food of all. (Pasta is made from the durum variety of wheat, while bread is generally made from more common varieties, such as red spring.)

“Wheat is a cool-season crop. High temperatures are negative for its growth and quality, no doubt about it,” says Frank Manthey, a professor at North Dakota State University who advises the North Dakota Wheat Commission. Already, a mere 1 degree Fahrenheit of global temperature rise over the past 50 years has caused a 5.5 percent decline in wheat production, according to David Lobell, a professor at Stanford University's Center on Food Security and the Environment.

By 2050, scientists project, the world's leading wheat belts—the U.S. and Canadian Midwest, northern China, India, Russia, and Australia—on average will experience, every other year, a hotter summer than the hottest summer now on record. Wheat production in that period could decline between 23 and 27 percent, reports the International Food Policy Research Institute (IFPRI), unless swift action is taken to

limit temperature rise and develop crop varieties that can tolerate a hotter world.

“International agricultural research centers and the private sector have woken up to the fact that higher temperatures are almost inevitable and they have little in their genetic toolbox to deal with them,” says Gerald Nelson, a senior research fellow at IFPRI. “We are all worried.”

The record-breaking summer of 2012—which brought the hottest July in U.S. history and the worst drought in 50 years (a drought that continues to afflict 60 percent of the nation)—hints at what may lie ahead. Corn and soybean yields plummeted in 2012, driving up world food prices, increasing hunger, and triggering protests in Indonesia that recalled the street riots that afflicted dozens of nations after the last big food-price jump in 2007–08.

“We stressed our farm crops this year pretty strongly, and many of them almost folded,” says Jay Fuhrer, a U.S. Department of Agriculture extension agent in North Dakota. “Does that concern you as a consumer? It should.”

As it happens, North Dakota, where Doug Opland has been growing durum wheat since he was a kid, is one of the centers of global pasta production. North Dakota agriculture officials will tell you, accurately, that their state produces some of the highest-quality durum in the world, boasting both a high protein count and the pale golden color demanded by discriminating pasta lovers. Durum, after all, thrives under conditions of limited rainfall and cooler temperatures, and North Dakota boasts both. It is late October, but as Opland drives his pickup onto a 300-acre field where he grew durum last year, his tires

leave tracks on a fresh dusting of snow.

“This is the new center of durum-wheat production in our state,” says Opland, a beefy 51-year-old who lives near the northwestern North Dakota town of Minot and sits on the board of directors of the U.S. Durum Growers Association. Durum used to be grown throughout North Dakota, but over the past 30 to 40 years, the growing zone has shifted farther west as weather conditions have changed. “Rainfall patterns have shifted,” explains Professor Manthey. “It’s become too wet in eastern North Dakota for durum.”

“I don’t think there’s any question” that climate change is already affecting wheat production in North Dakota, says Roger Johnson, a former durum farmer who was the state’s agriculture commissioner from 1996 to 2009. Johnson points out that Dakota Growers Pasta Co., one of the nation’s leading pasta producers, built a combined durum mill and pasta-making plant in Carrington, a town in eastern North Dakota, in 1993. At the time, the decision made economic sense. But as the durum zone has shifted west, transport costs have increased, putting the Carrington plant at a competitive disadvantage. “Looking at the cost of logistics, it has certainly had a negative impact,” says Ed Irion, the plant’s general manager.



An oil boom has benefited North Dakota and also upended its traditional way of life. (Evelyn Hockstein / Polaris)

Extreme and volatile weather patterns are especially threatening to durum, which is more finicky than conventional wheat varieties. If too much rain falls at the wrong time, durum's quality can be ruined. Too little rain isn't good either. Because durum is trickier to grow, farmers require a price premium over what conventional wheat earns. Already, Opland and other farmers complain, grain companies have been shrinking these premiums to boost their own profit margins. As climate change intensifies and durum gets even harder to grow, how high will the price premium have to rise to entice farmers to take the risk? Opland wonders whether he will plant durum at all next year.

Nonspecialists sometimes suggest that agriculture can easily adapt to climate change by shifting crops to more climatically congenial locations. Last July, Rex Tillerson, the CEO of ExxonMobil, called climate change "an engineering problem [that] has engineering solutions," one of which is to "move crop production areas around."

But reality is not so simple. “If you eat most of what you grow, as is the case for many farmers in the world’s poorest countries, moving your farm is not an option,” IFPRI’s Nelson points out. Indeed, even a more prosperous farmer in North Dakota can’t just pick up and move to follow changing weather conditions.

Tillerson’s proposal also ignores soil quality, the foundation of food production. “As a general rule, the farther west and north you go [in North Dakota], the more fragile the soil and the lower its fertility,” says Johnson. “So the durum production area runs out of a place to go.”

Moving west also puts durum in direct competition with the richest business enterprise in human history, an industry that has very different plans for the prairies of North Dakota.

Donny Nelson (no relation to Gerald) farms on land he inherited from his grandfather, who arrived in northwestern North Dakota 100 years ago to homestead a plot along Clark Creek. That’s Clark as in Lewis and Clark, the two most famous explorers in U.S. history, the men Thomas Jefferson commissioned to map the vast lands of the Louisiana Purchase in 1803.

Wearing an ear-flapped cap against the cold in late October, Nelson coaxes his truck uphill toward 20 acres of land where he and his brother grew durum last year. Now 14 of those acres are encircled by a chain-link fence and covered with concrete. Two green and yellow pumps belonging to the Hess Oil company are sucking oil from deep below the surface, their noses bobbing up and down like huge metallic birds dipping their beaks into a pond.

“We can’t stop ‘em from coming here,” says Nelson, shouting over the roar of the natural gas flaring yellow-white from a pipe at the far end of the plot. Why not? Because his family owns only the “surface rights” to these 20 acres. The underground “mineral rights” are owned by someone else, who leased the rights to Hess.

Nelson likewise had no way of stopping a second pumping station, 100 yards farther on, that is also located on land where he used to grow durum, nor of preventing the laying of two pipelines to carry these pumping stations’ oil and gas to market.

“This is the epicenter of the Bakken oil play,” says Nelson, driving through snow flurries to a third, larger pumping station that also occupies land previously planted with durum. “Hess has applied for 150 new drilling permits in our township alone and another 150 in the next township over. That’s 300 new pumping stations in just six square miles.”

The Bakken deposits have unleashed one of the largest oil booms in U.S. history. The development of controversial “fracking” technology, which enables drillers to extract oil and natural gas from previously inaccessible underground locations, has given rise to a massive expansion of production. In November the International Energy Agency projected that the U.S. will become the world’s leading oil producer by 2020, surpassing even Saudi Arabia. The Bakken deposits are a big reason why.

For North Dakota, the Bakken boom has been both blessing and curse. It has helped lower unemployment to 2 percent and generated enough tax revenue to give the state a \$1.6 billion budget surplus. However, it has also upended the state’s traditional lifestyle and

transformed a remote, ruggedly beautiful place into a sprawling, get-rich-quick industrial zone.

Teddy Roosevelt, the godfather of American conservationism, used to hunt big-horned elk on these prairies. Now his former ranch overlooks land that is dotted with thousands of oil wells and enough pipes flaring natural gas that, like giant torches, the flares are visible from outer space.

Such flaring is a major contributor to global warming. Flaring in the U.S. and the world's 19 other largest oil-producing nations releases as much greenhouse gas as does the entire nation of Italy, according to the World Bank.

The local water supply and its quality are also threatened. Fracking pumps millions of gallons of fresh water underground at high pressure to force oil and gas deposits to the surface. This water is extracted from an aquifer beneath North Dakota, "and we have no right to do that to future generations who'll need that water," says Nelson. Then the contaminated water is brought back to the surface and disposed of in huge storage ponds, risking spills that can pollute creeks and soil.

Perhaps most worrisome for the future of pasta, the Bakken oil boom is gobbling up prime farmland. By an accident of geology, the Bakken oil deposits lie beneath the very area to which climate change has shifted durum production, an area that in recent years also has accounted for most of the world's durum exports. The U.S. and Canada are the two leading exporters of durum, with most of their production coming from western North Dakota, eastern Montana, and the southern half of Saskatchewan. Lay a map of the durum production zone

onto a map of the Bakken oil deposits, and the two match almost exactly.

Driving west from Minot one afternoon, Opland passed a new housing development and a freshly completed La Quinta Inn—one of 18 hotels recently built to accommodate oil-boom workers. “That housing development covers 160 acres, the hotels even more,” Opland says. “That land won’t come back to farming, not in our lifetimes.”

Of course North Dakota is not the only place on earth where durum is grown. Durum originated in the Mediterranean basin 12,000 years ago, and 75 percent of the world’s durum is still grown there. The problem is, climate change is projected to hit the Mediterranean even harder than North Dakota. A region already known for its hot, dry climate will become even hotter and drier, scientists say. As the frequency and intensity of heat waves and drought increase, yields of nonirrigated crops are projected to decline by 5 to 15 percent in Italy and southern France by the 2050s, according to a new report by the European Environmental Agency. Yields in Spain and Portugal could fall by 15 to 25 percent.

In the short term, hotter temperatures might actually boost wheat yields, at least in some places. A study of western Australia, a key wheat exporter, found that, up to a 3.6°F rise in temperature, yields increased. But a coauthor of the study, Prof. Senthil Asseng of the University of Florida, cautioned that this result might not hold true in locations closer to the equator, such as India, the world’s second-largest producer and consumer of nondurum wheat after China.

“In India, a [3.6°F] temperature increase might be too much, because they already have high average temperatures,” says Asseng. Even this

increase would also make heat spikes, droughts, and other extreme weather events more frequent and severe. “In India, 90 percent of wheat production is irrigated,” says Asseng. “The biggest threat to their production is, where will that water come from in the future?”

Global temperatures are headed for increases much larger than 3.6°F. A new report by the accounting firm PricewaterhouseCoopers warns that, on current trends, earth will warm by a staggering 11°F by 2100. Such an increase would be incompatible with civilization as we know it, scientists say. Joe Romm, a former Department of Energy official who blogs at Climate Progress, warns that “Dust-Bowl conditions could stretch all the way from Kansas to California by mid-century.”

Fred Kirschemann is one of the deans of sustainable agriculture in the U.S. His family farm in central North Dakota has been growing durum and other crops since the 1950s and was certified organic in 1980. Conventional agriculture is a losing strategy against climate change, Kirschemann argues, for two reasons. First, conventional agriculture makes climate change worse by consuming large amounts of fossil fuel (to make fertilizer and run equipment). Second, conventional agriculture is also exceptionally vulnerable to climate change, largely because it favors vast plantings of single crops—so-called monocultures—that lack the biological diversity to cope with extreme weather, pests, diseases, and other consequences of rising temperatures.

“The conversation I’ve been having with the young family that’s now managing my farm is: let’s imagine that 10 years from now extreme weather events are twice as common as they are today, and oil is at \$300 barrel, so fertilizer costs jump,” says Kirschemann. “That’s the kind of thinking we need to be doing.”

But that's not a conversation many agricultural stakeholders in the United States appear ready to have. Congress spent much of this year preparing a new Farm Bill, the legislation passed every five years that shapes U.S. food and agricultural policy. Despite watching the Farm Belt suffer one of the harshest summers in memory, neither Democrats nor Republicans so much as mentioned climate change in their respective bills. For its part, the National Pasta Association also "has not address[ed] the future of durum as it relates to climate change," says a spokesperson.

In North Dakota, current Agriculture Commissioner Doug Goehring says man-made climate change does not exist. Goehring says it does not bother him that the National Academy of Sciences, like its counterparts in every other industrial nation, has repeatedly affirmed otherwise. Goehring, a Republican, adds, "I think an agenda is being pushed."

At a durum and wheat mill in Minot owned by the Philadelphia Macaroni Co., general manager Kevin Schulz is equally dismissive. Philadelphia, he says, makes pasta from durum milled at this plant for Kraft and Campbell's Soup.

"I don't think we've ever given it a thought," he replies with a grin, adding, "I don't believe in man-made climate change."

Informed that scientists at both the National Oceanic and Atmospheric Administration and the Environmental Protection Agency linked the record heat and drought of summer of 2012 with man-made climate change, Schulz says this is news to him. Nevertheless, he holds firm to his conviction that climate change is a ruse to justify greater government regulation: "I just don't think we've got enough data to

say climate change is real.”

Not everyone is sticking his head in the sand. Barilla, the largest pasta company in Italy, claims to be taking a number of measures. To limit its climate-related risks, says spokesperson Marina Morsellino, Barilla is globally diversifying its supply chain so that bad weather in one region does not leave the company without adequate supplies of durum. It is also “developing new varieties more resistant to ... extremely dry or wet conditions,” she adds, while encouraging farmers to employ such traditional practices as rotating durum with numerous other crops, a strategy Morsellino says can reduce greenhouse-gas emissions by 55 percent.

Even in North Dakota, some of the most old-school farmers are coming around. Glen Bauer, a 71-year-old farmer who describes himself as “very conservative” politically, nevertheless is a proud advocate of sustainable agriculture. As the year’s first full snowstorm coats his fields with an inch and a half of white, Bauer extols the virtues of “no till” agriculture and diversified crop rotation, both of which enhance the health and fertility of soil—the first line of defense against climate change (though Bauer says he hasn’t decided yet whether climate change is real).

Instead of digging up the soil every spring before planting and again in autumn to clear the stalks left behind after harvest, Bauer keeps the soil sheltered by cover crops. In spring he plants anew with a “no-till drill” that punches seeds lightly through the cover crop and into the soil below.

“When we get hotter, drier weather, no till makes a big difference,” Bauer says, his thick-fingered hand reaching down to scrape snow

from a field of durum harvested in August. “This cover crop is keeping moisture in the soil for next year.” Pointing across the field through swirling snow, he adds, “If you went to my neighbor’s field, where he tills the conventional way, the soil would be bare. When temperatures warm up in the spring, his soil will dry up real quick, which can become a problem in July.” By improving the soil’s drainage, the use of no till and multiple-crop rotation also provides resilience to the very wet weather that punished North Dakota durum growers in 2011.

Above all, sustainable agriculture builds the soil’s organic matter and overall health. “Microorganisms and earthworms like cover crops because it keeps the soil cooler,” Bauer explains. “When we used to do conventional farming, we never saw earthworms in our fields. Now we see lots of them.”

The end of pasta will not come overnight. If it comes—and it might still be avoided, if humans act swiftly enough—it will come in fits and starts, as harvests falter one year but not the next, and it will be expressed more in shockingly high prices for pasta than in an absolute disappearance of spaghetti and macaroni from grocery-store shelves.

But this need not happen, not if America finally gets serious about climate change. That means, among other things, shifting to climate-smart agriculture. If we want to continue enjoying pasta and many other foods we currently take for granted, we need more farmers to emulate the sustainable practices of Glen Bauer and Fred Kirsche-mann. We also need, desperately, to limit global warming, because even the most skillful adaptation measures cannot cope with 7°F of global temperature rise. That means the federal government must stop ignoring the mounting climate crisis and take swift aggressive

action to slash greenhouse gas emissions.

The televised horrors of Hurricane Sandy may help break the climate silence that still afflicts many Americans. “Mother Nature is better at bringing people to Jesus than any politician is,” notes Jay Fuhrer, the extension agent. But a fear of offending friends and neighbors still inhibits many. “The first thing we always talk about here is the weather, because it affects our lives so much,” says Donny Nelson. “But global warming, people just don’t get into it.”

Mark Hertsgaard is a fellow at the New America Foundation and the author of six books that have been translated into 16 languages, including, *Hot: Living Through the Next Fifty Years on Earth*.