

Thomas Homer-Dixon

## Climate change's costs hit the plate

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In the mid-1980s, when I was a doctoral student at the Massachusetts Institute of Technology and beginning to study climate change, I attended a lecture by a specialist in plant physiology at nearby Harvard University. He spoke about global warming's impact on crop productivity. He was quite optimistic. More carbon dioxide in the air, he explained, causes certain kinds of plants to grow faster. So, on balance, food output should rise in a warmer and CO<sub>2</sub>-rich world.

I chased him down after the lecture and pressed him on things that could make plant response more complex. If plants absorb more CO<sub>2</sub>, I asked, won't that change the nitrogen-carbon balance in their tissues and make them less nutritious? And what about other factors that might change in a warmer world, such as soil moisture and the distribution of weeds and pests – shouldn't we take them into account, too?

He agreed that the issue was more complex than he'd suggested. "But we don't have good data on these other factors yet," he said, "so I didn't talk about them."

Almost three decades later, we have vastly more data, and the picture is far less rosy. We've learned that in the real world, unlike in experimental plots that control everything except ambient CO<sub>2</sub> concentration, factors like drier soil and worse pest infestations can swamp carbon dioxide's positive effect. And one thing that didn't figure much in experts' analysis in those days, and which I didn't ask the Harvard speaker about, turns out to be a really big deal: heat shock.

In the past few years, agricultural scientists have shown that crops critical to humankind's caloric supply – including corn and soybeans – are extremely sensitive to even short periods of high temperature. Output of these crops increases as the temperature rises to about 30 Celsius, but then it falls sharply as the temperature keeps rising. For instance, just one day of 40-degree weather will produce a 7-per-cent drop in the annual yield of corn compared with its yield if the temperature stays at 29 through the growing season.

In the past, 40 degrees might have seemed unusual, but nowadays it isn't. In recent weeks, temperatures have topped this level repeatedly in key corn-growing states such as Nebraska, Iowa, Illinois and Indiana. The U.S. grain-growing regions are being hit, in fact, by a particularly brutal combination of drought and high heat.

Climate-change skeptics will dismiss this summer's North American weather as just that – weather. They'll argue it says nothing about longer-term climate trends. It's true that the U.S. droughts of the 1950s and 1930s were worse than the current one, at least so far. But even without getting into the causes of this unusually hot and dry summer, data clearly show that the frequency of extreme weather is soaring around the world. For example, in the 1950s, summertime heat events that scientists classify as abnormally severe – technically, those that are at least three standard deviations from the average temperature and that experts call "three-sigma events" – affected less than 1 per cent of Earth's land area. Now, in any given summer, three-sigma events affect about 10 per cent of our land area.

What's happening in the United States is a window on the future. If humankind continues on its current emissions path, and if countries don't invest far more in research to develop crops resistant to drought and high heat, climate change will depress global food production in the coming decades, just when our population is climbing toward 10 billion.

It sounds harsh, but in light of these realities, this year's U.S. drought is good news. The sooner we get serious about climate change, the better our chances of keeping temperatures

from rising too high. The drought and heat wave have already led to record corn prices. The world's integrated grain markets will transmit these higher prices around the world, in time affecting just about everyone.

People may not care much about climate change, but most do care about the price of food because it affects their everyday lives. Fears about imperiled food security may be our best hope for breaking through widespread climate-change denial and generating the political pressure to do something, finally, about the problem.

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