EATING THE EARTH

The burgeoning global food trade is a lifeline for billions, but it is fragile and hard on the planet

By **Joel K. Bourne, Jr.**

Photography by **George Steinmetz**

Dock workers unload frozen skipjack and yellowfin tuna from a ship in Bangkok, bound for the Thai Union cannery, one of the world's largest tuna processors. Caught by purse seiners in the western and central Pacific Ocean, the fish will become Chicken of the Sea in the United States and other canned tuna brands in Europe.

At the risk of sounding like a Facebook post from 2005, this morning for breakfast I had oatmeal from Ireland, topped with a banana from Costa Rica and sugar from Brazil, and coffee composed of beans from "aromatic Ethiopia, earthy Sumatra, lively Colombia, and chocolatey Honduras." I then fed my dog kibble containing seaweed extract that most likely came from China and fish oil that was probably from Peru.

Old Boomer and I are not alone. Despite decades of admonitions from nutritionists and environmentalists to "eat locally, think globally," our collective diets are more international than ever. A decade ago, some 80% of the world's population lived in countries that were net importers of food, and the proportion has only grown since then. By 2050, fully half the world's people may depend for survival on calories produced oceans away.

Arid nations in the Middle East and North Africa are currently the world's most import dependent, with 11 of the 16 nations importing most of their staple grains. Saudi Arabia and its Persian Gulf neighbors import 90% of their food. Even countries with rich farmland are heavy importers of some foods, however. Before Brexit, imported bananas provided 44% of the United Kingdom's total requirement of vitamin C, needed to keep its old nemesis of scurvy at bay.

The growth of the global food trade has brought huge benefits. As the world's population has surged since the 1960s, food availability has more than kept up. Producer nations have created jobs and boosted export income, and nations that are ill-suited for food production or that frequently suffer shortfalls from droughts or floods have gained food security. Imported food from far-flung places has also made menus more diverse and nutritious, and far more enjoyable.

But recent studies have underscored that global food trade has its costs. It takes a growing toll on the environment and can jeopardize public health, for example by supplying red meat or highly processed foods to countries where they were once scarce or unaffordable. The food trade is also increasingly vulnerable to global disruptions that send food prices soaring, as shortages during the COVID-19 pandemic made clear.

"I think the pandemic was a societal wake-up call for many people," says Marianela Fader, who studies global food trade at the Ludwig Maximilian University of Munich. "Rich countries that have not had lack of supply of any kind in the last decades suddenly had cuts in supplies. That started discussions about how dependent do we want to be? And on exactly what?"

About one-quarter of all food produced in the world is traded on international markets, and 10 nations supply the bulk of it. In 2023, the Food and Agriculture Organization of the United Nations estimated the global food trade had grown into a $2 trillion business, nearly quadrupling since 2000.

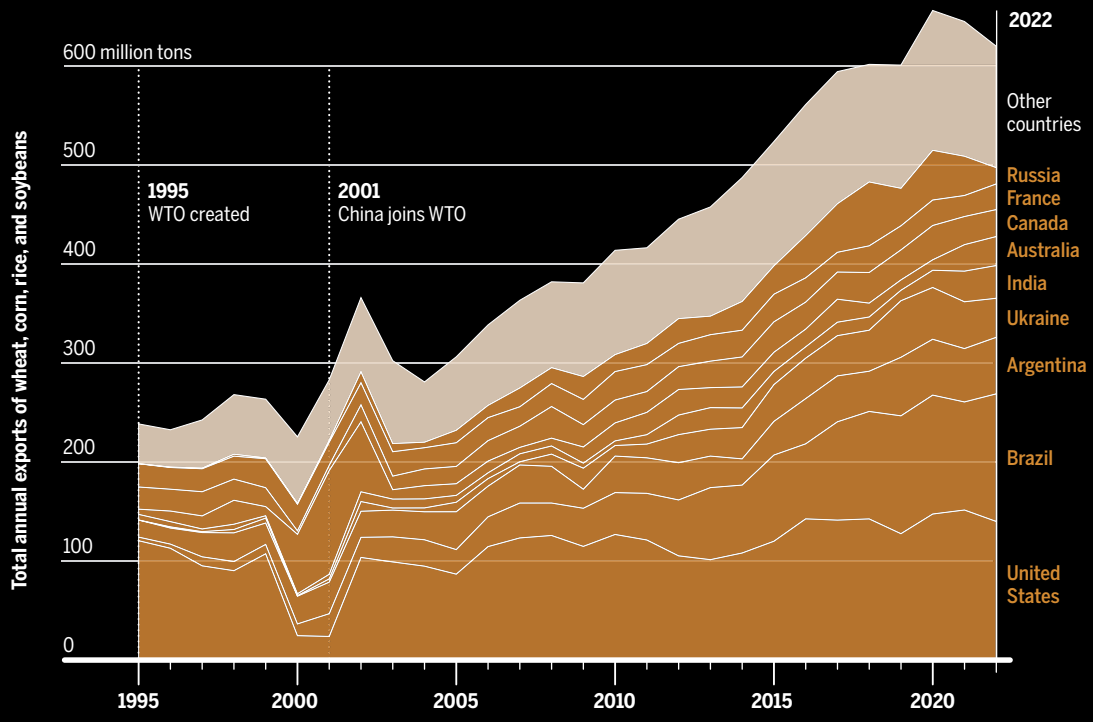
The massive uptick has two primary drivers, says Joseph Glauber, former chief economist at the U.S. Department of Agriculture and now senior research fellow at the International Food Policy Research Institute. The first was the launch of the World Trade Organization (WTO) in 1995, which helped remove trade barriers such as price supports and tariffs, leading governments to steadily reduce their national food reserves. The other was China joining WTO in 2001 and almost overnight becoming one of the world's largest importers of food products from countries such as Brazil, Argentina, Canada, and the United States. "It's hard to overstate

PHOTO: GEORGE STEINMETZ

Giant excavators move mountains of soybeans at the Brazilian port of Santos, the largest in Latin America. Growing global demand for the oil- and protein-rich seeds has fueled a ninefold increase in soy production in Brazil since 1985. The bulk of that harvest is shipped to China, which consumes about 70% of global soy exports.

Global takeout

International food trade has been on a massive uptick since 1995, when the World Trade Organization (WTO) began to lower trade barriers. Since the end of the Asian financial crisis in the late 1990s, exports of staples such as wheat, corn, rice, and soy have nearly tripled, with nine nations feeding most of the world.



In 2022
nine countries
exported
80%
of the world's wheat, corn, rice, and soybeans.

134
countries
relied on those
nine exporters
for more than half their imports of those crops.

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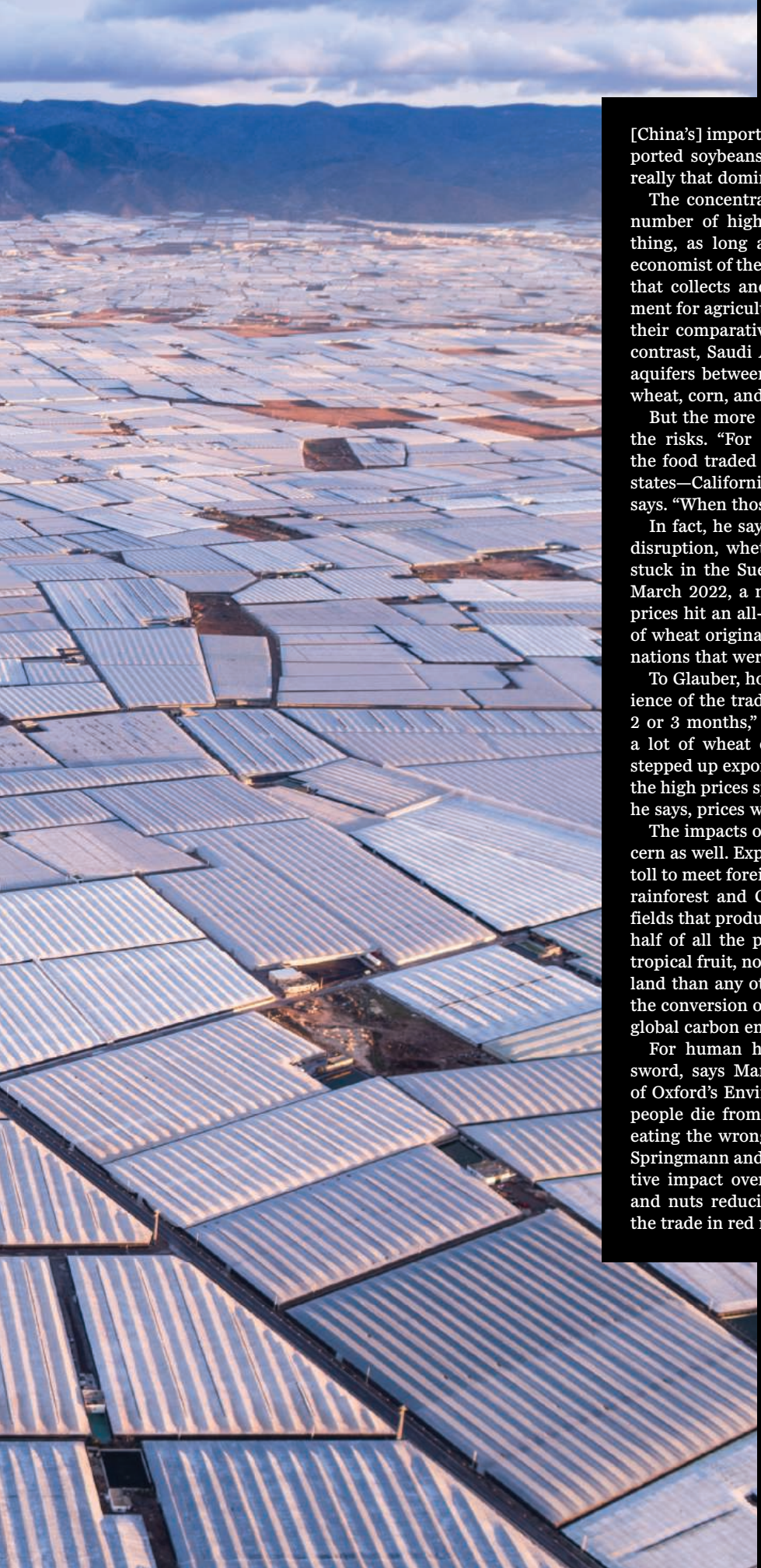


[China's] importance," Glauber says. "About 70% of the world's imported soybeans go to China. You don't have any other country really that dominant."

The concentration of global food exports in a relatively small number of highly efficient producing countries can be a good thing, as long as it works, says Gilberto García-Vazquez, chief economist of the Observatory of Economic Complexity, a nonprofit that collects and publishes global trade data. One classic argument for agricultural trade liberalization is to let countries exploit their comparative advantages and grow what they grow best. In contrast, Saudi Arabia drew down nearly 80% of its fossil water aquifers between the 1970s and the mid-2010s to irrigate thirsty wheat, corn, and alfalfa fields.

But the more eggs you place in fewer breadbaskets, the greater the risks. "For example, the U.S. exports around a quarter of the food traded worldwide and 80% of that is from a handful of states—California, Oregon, Washington, Texas," García-Vazquez says. "When those states have a drought, the whole world suffers."

In fact, he says, the food supply chain is now so tight that any disruption, whether it's drought in a major breadbasket, a ship stuck in the Suez Canal, or a war, can send prices spiraling. In March 2022, a month after Russia invaded Ukraine, global food prices hit an all-time high. "Around 30% to 40% of global exports of wheat originate from those two countries, and you saw several nations that were highly affected," García-Vazquez says.

To Glauber, however, the war in Ukraine is a lesson in the resilience of the trade system. "We had record high prices in the first 2 or 3 months," he says. "But by midsummer of 2022, there was a lot of wheat on the market from other countries that really stepped up exports." Australia and India had surpluses to sell, and the high prices spurred exports from Brazil. By the end of the year, he says, prices were below preinvasion levels.

The impacts of the food trade on the planet are a source of concern as well. Exporting countries often pay a heavy environmental toll to meet foreign demand. In Brazil, huge swaths of the Amazon rainforest and Cerrado savanna have been lost to pastures and fields that produce beef and soybeans. Costa Rica, which produces half of all the pineapples traded on the planet as well as other tropical fruit, now uses more pesticides per hectare of agricultural land than any other country. Livestock, fertilizers, transport, and the conversion of forest to fields together account for one-third of global carbon emissions (see Policy Forum, p. 974).

For human health, the global food trade is a double-edged sword, says Marco Springmann, a researcher at the University of Oxford's Environmental Change Institute. "If you look at what people die from, one of the biggest contributors is actually just eating the wrong stuff," he says. In a 2023 study in *Nature Food*, Springmann and colleagues found the global food trade has a positive impact overall, with imports of fruits, vegetables, legumes, and nuts reducing annual mortality by 1.4 million globally. But the trade in red meat—which has been linked to diabetes, cancers,

Covering close to 340 square kilometers of Andalusia, the greenhouses of Spain's *mar de plástico*, or sea of plastic, grow much of Europe's winter fruits and vegetables. But the lucrative exports have taken their toll, with harsh working conditions for migrant laborers, an overexploited aquifer, and 30,000 tons of plastic waste each year. PHOTO: GEORGE STEINMETZ

The celery harvest in California's Salinas Valley has been described as "ballet with a machete." Nearly all the crop is cut by hand and processed in the field. California produces 80% of all celery sold in the United States and helps make the country one of the top celery exporters in the world, supplying 26% of global exports by value.

Day laborers sort red chilies that have been dried in the scorching sunshine of India's Andhra Pradesh state. The spicy red peppers are native to South America but were brought to India by Portuguese traders in the early 1500s. Today, the country produces more than 40% of the world's dried red chili, nearly all grown by smallholder farmers.

PHOTOS: GEORGE STEINMETZ

Women sort shrimp prior to processing at Avanti Frozen Foods, one of the largest producers in India, which is responsible for some 30% of the world's shrimp exports. The company produces 40 tons of farmed shrimp each day from 630 hectares of ponds, with 75% exported to the United States, where Costco is a major customer.

At a Del Monte packing plant in Costa Rica, workers prepare boxes of Del Monte Gold pineapples for export. The sweeter, less acidic variety was introduced in 1996 and kicked off a pineapple boom for Costa Rica. Vast monocultures—along with heavy pesticide use—have enabled the small country to supply half of global pineapple exports.

PHOTOS: GEORGE STEINMETZ

With their annual income at their fingertips, a family of saffron farmers pluck delicate crimson stigmas from crocus flowers grown high in India's Kashmir Valley. Hand-harvested, with a prized flavor profile, Kashmiri saffron brings top dollar worldwide. After carefully drying the fragile threads in the shade, farmers sell them for $3 a gram—one-tenth of the U.S. retail price.

PHOTO: GEORGE STEINMETZ

and cardiovascular disease—increases global mortality by about 150,000, the researchers estimated. Such chronic diseases add to the burden on importing nations' health care systems.

Countries that have made red meat a primary export commodity—including Germany, Denmark, Ireland, and the U.S.—"basically export disease," Springmann says. Future trade agreements should take those impacts into account, he adds: "It doesn't make much sense to have tariffs lowered on foods that make us unhealthy."

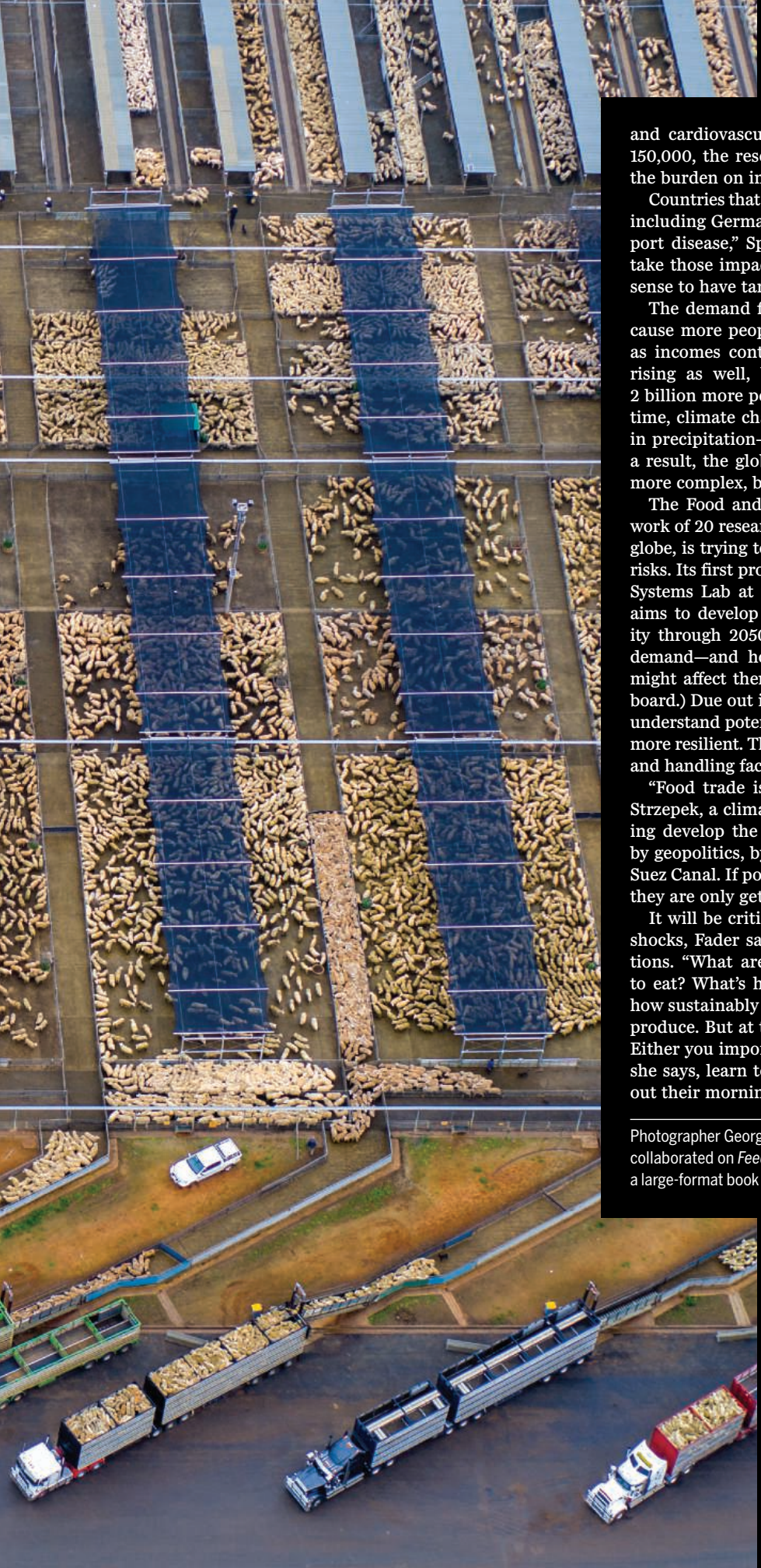
The demand for meat is expected to keep growing, in part because more people in developing nations will be able to afford it as incomes continue to rise. Demand for food overall will keep rising as well, because Earth's population is projected to add 2 billion more people until it peaks in the mid-2080s. At the same time, climate change—including rising temperatures and changes in precipitation—will likely lead to lower, more volatile yields. As a result, the global food system will not only become bigger and more complex, but also more vulnerable.

The Food and Climate Systems Transformation Alliance, a network of 20 research institutions and stakeholder groups around the globe, is trying to help nations forecast their growing food security risks. Its first project, led by the Abdul Latif Jameel Water and Food Systems Lab at the Massachusetts Institute of Technology (MIT), aims to develop a global index of each country's food vulnerability through 2050, based on projections of global production and demand—and how price spikes, climate change, and geopolitics might affect them. (Full disclosure: I am on the project's advisory board.) Due out in 2025, the index is intended to help policymakers understand potential threats and take steps to make their countries more resilient. This might entail building new ports or grain storage and handling facilities, or increasing domestic production.

"Food trade is a global interconnected activity," says Kenneth Strzepek, a climate, food, and water specialist at MIT who is helping develop the index. "It's interconnected by financial markets, by geopolitics, by climate, and by crazy boats that get stuck in the Suez Canal. If policymakers aren't aware of those interconnections, they are only getting a partial picture of what could happen."

It will be critical for countries to adapt quickly to supply-chain shocks, Fader says—and perhaps to start asking some hard questions. "What are we eating?" she asks. "How much do we need to eat? What's healthy, what's not? All of that. How we produce, how sustainably we produce, where we produce, how efficiently we produce. But at the end of the day for a country it's pretty simple: Either you import, or you increase your own production." Or even, she says, learn to do without. "People would be very cranky without their morning coffee, but they will not die, right?" ■

Photographer George Steinmetz and environmental journalist Joel K. Bourne, Jr. collaborated on *Feed the Planet: A Photographic Journey to the World's Food*, a large-format book published this month.



The largest sheep sale in the world takes place every Thursday (save holidays) at the Wagga Wagga Livestock Marketing Centre in New South Wales in Australia, where nearly 2 million sheep are bought and sold each year. Australia's lamb exports have surged as global demand for meat continues to rise, with China a major market. PHOTO: GEORGE STEINMETZ