



CONGRESSIONAL
PROGRAM

aspen institute

Strategies to Ensure Global Food Security:

U.S. Policies to Sustain Supply, Relief,
and Advance Prosperity

Bellagio, Italy
April 10-15, 2023





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AGENDA

MONDAY, APRIL 10:

U.S. participants depart the United States today.

TUESDAY, APRIL 11:

U.S. participants arrive in Bellagio, Italy by mid-afternoon.

7 – 9 PM: Working Dinner

Seating is arranged to expose participants to a diverse range of views and provide the opportunity for a meaningful exchange of ideas. Scholars and lawmakers are rotated daily. Discussions will focus on food security in the United States and around the world.

WEDNESDAY, APRIL 12:

8 – 8:55 AM: Breakfast

9 – 9:15 AM: Introduction and Framework of the Conference

This conference is organized into roundtable conversations, a luncheon, and pre-dinner remarks. This segment will highlight how the conference will be conducted, how those with questions will be recognized, and how responses will be timed to allow for as much engagement as possible.

Speaker:

Charlie Dent, *Executive Director, Aspen Institute Congressional Program; Vice President, Aspen Institute*

9:15 – 11 AM: Roundtable Discussion

The World Food Price Crisis

After the height of the COVID-19 pandemic, supply chain issues, inflation, and Putin's ongoing war in Ukraine, a major agricultural exporter, Americans saw the economic effects of these events firsthand with empty grocery store shelves and high food prices. These impacts have shown that while food security remains a humanitarian issue in developing nations, it also can affect world powers, including the United States.

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World food price crises are occurring with increasing frequency. We are in the third crisis since 2008, however this is the first to have a significant impact on retail prices in the U.S. and other high-income countries. In low-income countries consumers have suffered severe impact on their food security in all three price spikes.

The current food price crisis is more pronounced and is having a greater impact in all regions of the world. When COVID-19 closed the economy, American consumers quickly shifted from two-thirds of their food expenditures going toward food consumed away-from-home to two-thirds at-home, and supply chains struggled to adjust to that sudden shift. Income transfers from the government sustained consumer purchasing power in the face of losses of employment due to COVID-19. Food processors, particularly animal slaughtering facilities, struggled to sustain production while trying to make the work environment safe enough for employees to continue to come to work.

Animal diseases that caused loss of farm production capacity in several countries have further amplified food price increases. China lost a significant fraction of its pig population (the largest in the world) to a swine disease, and more recently, avian influenza caused the destruction of a substantial fraction of the U.S. laying hen population, causing the price of eggs to explode.

On top of these forces that were already causing food prices to rise came Putin's invasion of Ukraine, followed by sanctions on economic relations with Russia. Both Russia and Ukraine are important agricultural exporters, and Russia is also a significant supplier of fertilizer, an essential agricultural production input to the world market. Both agricultural commodity prices and the cost of agricultural production around the world rose further.

This conference will probe in depth the fundamental forces driving food security at the individual, national and global levels today, and even more importantly, in the future in a world in which all agro-ecosystems are migrating due to climate change.

Speakers:

Christopher Barrett, *Stephen B. & Janice G. Ashley Professor, Dyson School of Applied Economics and Management, and Professor, Brooks School of Public Policy, Cornell University*

Tjada D'Oyen McKenna, *CEO, Mercy Corps*

Paul Polman, *Business Leader; Co-author of "Net Positive"*

11 – 11:15 AM: Break

11:15 AM – 1 PM: Roundtable Discussion
Global Food Security

Global food security is defined as the extent to which the world can produce enough food containing all the essential nutrients (calories, amino acids, vitamins, and minerals) to feed the world's larger population better than today at reasonable cost without damaging the environment. This challenge must be addressed in a holistic manner in which nutrient-dense foods, e.g. fruits and vegetables that have high vitamin and mineral content, are given high priority. Historically, too much focus has been on grain production, which supplies calories, but generally leaves deficiencies in various amino acids, vitamins, and minerals.

In 1798, Thomas Malthus, a British economist known for his theory on population, wrote that food production could not keep up with population growth and that starvation would limit the world's population. With the development of ocean shipping, vast new areas of land were brought into agricultural production in North and South America and Oceania. Engineering research developed machines that enabled every farmer to cultivate far larger areas of land and to manage larger herds of livestock and flocks of poultry. Research on genetics and the control of insects, diseases, and weeds resulted in big increases in production per acre of land and per farm animal. Instead of limiting population as Malthus predicted, global food output has grown faster than consumption, the long-term cost of food has trended downwards, and the world's population is now eight times larger than when Malthus wrote his book. There has always been variability around this trend line, but the three price spikes in the last 15 years suggest they are becoming more frequent.

All agricultural production, regardless of the production system – conventional, organic, or regenerative – begins with the genetic potential embodied in the plant seed or animal egg. Once a plant germinates or an animal is born, how much of that genetic potential is realized depends on adequacy of nutrition for the species' requirements, prevention of diseases that inhibit its growth, and avoidance of competition for nutrients (from weeds in plants and parasites in animals) and for light in the case of plants.

The two basic resources on which plant growth is based are the land, from which crops receive their required nutrients (nitrogen, phosphate, potassium, and some micronutrients), and water. To these must be added the climatic conditions above the land which determine the levels and variability of temperature and precipitation.

There is little more arable land available worldwide (certainly less than 10 percent) that is not presently forested or subject to erosion or desertification. Moreover, loss and degradation of many soils continues. The area of land in food production could be

expanded more than this, but only by destruction of forests, with accompanying loss of wildlife habitat, biodiversity, and carbon sequestration capacity, all unacceptable environmental outcomes. The only environmentally sustainable alternative is to increase productivity on the fertile, non-erodible soils already in crop production. Most of that available cropland is in remote areas of South America and Sub-Saharan Africa, where infrastructure is minimal, and soils are inferior in quality to many already in production.

There is an area of land larger than what is in crop production which does not receive enough rainfall for annual cropping which grows grass that ruminant livestock (cattle, sheep, goats, bison, deer, and camels) can convert into milk and meat, thereby contributing to the world food supply.

Land may not be the most binding constraint on future global food production. Water is likely to be even more limiting. In their irrigation, farmers account for 70 percent of the world's use of fresh water. With the rapid urbanization underway, cities are outbidding farmers for available fresh water. The world's farmers will likely have access to less fresh water in the future than today. To sustain present food production levels, they will have to increase the "crop per drop," the average productivity of the water they use.

Complicating this picture is the reality that the climatic constraints on agriculture are changing. Greater warming is occurring over land than over water, and the greatest increase is at the higher latitudes. The spatial distribution of precipitation is changing, and there is increased frequency of extreme climatic events, e.g. droughts and floods. Farmers need access to seeds that embody greater tolerance to high temperatures and resilience in the face of droughts, flooding and other adverse conditions. Farmers in some geographic locations will find it necessary to change what crops they are growing, and more of world agricultural production will likely need to move through international trade. In addition, farmers are being asked to help mitigate climate change by sequestering more carbon in the soil and reducing greenhouse gas emissions from their production practices.

To the definitions of global and national food security must be added "with minimum loss between the points of production and consumption." All agricultural commodities (and marine products, which also make an important contribution to global nutrition) are perishable. An estimated third of world food production is lost between the points of production and consumption. In low-income countries, where the marketing infrastructure is often deficient, the heaviest losses occur between the farm and retail market, and in high-income countries, the largest losses occur as food waste after retail. Grains which are stored with too high a moisture content spoil, and most fruit and animal products, e.g. milk, meat, and fish, spoil in the absence of refrigerated transport and storage.

This session will review the natural constraints on the world's farmers' ability to produce enough food in an environmentally benign manner to feed the world's larger population better than today. It will take a holistic approach that recognizes the importance of producing enough of all the essential nutrients to sustain human health.

Speakers:

David Beasley, *Former Executive Director, United Nations World Food Programme*

Máximo Torero Cullen, *Chief Economist, Food and Agricultural Organization of the United Nations*

1 – 2 PM: Working Lunch

Discussion continues between members of Congress and scholars on global food security.

2 – 4 PM: Individual Discussions

Members of Congress and scholars meet individually to discuss topics raised during the conference. Scholars available to meet individually with members are David Beasley, Chris Barrett, Catherine Bertini, Robert Paarlberg, Pamela Ronald, Joseph Glauber, Máximo Torero Cullen, Devon Klatell, Tjada D'Oyen McKenna, Catherine Russell.

7 – 9 PM: Working Dinner

Seating is arranged to expose participants to a diverse range of views and provide the opportunity for a meaningful exchange of ideas. Scholars and lawmakers are rotated daily. Discussions will focus on the world food price crisis and global food security.

THURSDAY, APRIL 13:

8 – 8:55 AM: Breakfast

9 – 11:30 AM: Roundtable Discussion

Crisis of Global Malnutrition

According to the Food and Agriculture Organization (FAO) of the United Nations, “food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life.” Adequate nutrition and absence of disease are the two essential conditions for health.

Both overnutrition and undernutrition cause hundreds of millions of premature deaths world-wide each year. The health problems associated with obesity are widely addressed

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in the media. Less well reported is the even larger number of deaths every year from starvation from lack of calories and from nutritional deficiency diseases from inadequate intake of all the essential amino acids, vitamins, and minerals, particularly vitamin A, iodine, iron, and zinc.

There are three essential conditions for individual food security:

1. Is there a safe, reliable, and reasonably priced supply of all essential nutrients available from local production or the market year around?
2. Does the household (or individual) have sufficient purchasing power to access a nutritionally balanced diet from home-grown sources or the marketplace?
3. Is a person healthy enough so the nutrients ingested can be absorbed and used by the body? Food intake is less effective at contributing to health if a person is sick or has parasites, just as medicine is less effective if a person is nutritionally compromised. The two essential contributors to health, nutrition and medicine, are mutually reinforcing.

Very low-income people spend the largest fraction of their income on food. Before COVID-19 struck, an estimated (FAO) 750 million people (10 percent of the world's population) suffered "severe food insecurity," and 690 million went "hungry." According to the FAO's definition, people suffer "hunger" if they lack sufficient purchasing power to access even 1,800 calories per day, not enough to put in a medium level of physical activity. An estimated 75 percent of the extreme poverty in the world is rural, and most are farmers. The majority are female, and half are children. Despite being farmers, most of the extreme poor are net food buyers.

War, natural disasters, and economic crises cause a great deal of hunger in the world, but chronic hunger, which is much more widespread, is due mainly to poverty. Emergency feeding programs, such as the World Food Programme, play an essential role in addressing human crises. However, to "solve" the world's chronic hunger problem (Sustainable Development Goal #2), the world's poverty problem (Sustainable Development Goal #1) must be solved. For the health of the planet, these goals must be attained in a sustainable manner. To do this, the entire food system must be involved.

The world experienced rapid progress in reducing poverty during 1990 to 2017, but an estimated 131 million people worldwide were pushed back into extreme poverty during COVID-19 (Pew). The "new poor" tend to be more urban than rural, living in congested urban settings and working in sectors affected by lockdowns and mobility restriction, and more engaged in informal services or manufacturing, including food processing. Food availability was disrupted in many places, and with the increase in food prices, low-income people have been the most adversely affected by the current food price crisis.

This session will review the response to this crisis and address the longer-term challenge of eliminating global poverty and hunger. To do this, food security will be addressed at the individual, national and global levels.

Speakers:

Catherine Bertini, *Distinguished Fellow, Chicago Council on Global Affairs; Former Executive Director, World Food Programme*

Devon Klatell, *Vice President, Food Initiative, The Rockefeller Foundation*

Catherine Russell, *Executive Director, UNICEF*

11:30 – 11:40 AM: Break

11:40 AM – 1 PM: Roundtable Discussion

International Trade and Food Security

The global price of an agricultural commodity is determined by the balance between the volume supplied to the world market by exporting countries and the volume of that commodity purchased from the world market by all importing countries. Dependent as it is on rainfall and temperature, agriculture is an inherently risky business. International trade in agricultural commodities is the great balancing wheel that moves farm products from surplus production regions to deficit areas at any point in time. In this sense, international trade is an important food security risk management tool for every country.

With climate change shifting all agro-ecosystems and increasing the frequency of extreme climatic events such as droughts and floods, international trade is likely to take on an even greater national risk management role in the future. International trade needs to be kept as open as politically possible if world markets are to play this balancing wheel and risk management function.

In countries whose natural conditions make it possible to competitively produce more of a commodity than domestic consumers buy, the international market provides larger farm income and the opportunity for the farm sector to make a positive contribution to the country's balance of trade. The U.S. exports about a quarter of its agricultural production, contributing significantly to farmers' income and the U.S. balance of trade.

National food security is the potential for self-sufficiency that is both economically efficient and environmentally sustainable within a given country. The food supply is strategically important to every government. Every country needs to have a reliable,

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safe and nutritious, reasonably-priced supply of food available from some combination of domestic production plus imports minus exports. Political realities prevent any government from putting its citizens in a position of being dependent on imports for its entire food supply. Every government must assess the risk-benefit balance between dependence on imports vs. the cost of national self-sufficiency. This is especially relevant in countries whose natural conditions make production inherently costly (e.g. in desert countries) or they simply lack a sufficient area of arable land. Perceived reliability of supply is critical in an importing country's willingness to depend on the world market for part of its food supply.

The volume of future international trade in food and agricultural products will be determined by the dynamic changes that occur in the demand for food relative to the growth in production potential in each country. The world's population is projected to grow 22 percent from the present eight billion to about 9.8 billion by 2050. Of the 1.8 billion increase in the number of global mouths to be fed, about 950 million are projected to be in Sub-Saharan Africa, about 500 million in South and Central Asia, and about 200 million in North Africa and the Middle East. The population of East Asia is declining.

East and South Asia have twice as much of the world's population compared to its arable land, and virtually all their potentially arable land is already in production. The Middle East and North Africa have land, but they lack enough fresh water. It is hard to construe a scenario in which these three regions can be self-sufficient in food in the future; East Asia and the Middle East and North Africa are already large agricultural importing regions. Sub-Saharan Africa has roughly equal percentages of the world's population and arable land now, but it is the one region whose population is expected to almost double by 2050. A large source of uncertainty about the world's future food supply-demand balance is how successful Sub-Saharan Africa will be in achieving its food production potential, which greatly exceeds present levels. This will determine whether Sub-Saharan Africa in the future is a large food importer—on commercial or concessional terms—or even a net food exporter.

It is important to emphasize that population growth creates need, but not effective demand for more food. Low-income people already spend the bulk of their meager incomes on food. In 2015, before COVID-19, 41 percent of Sub-Saharan Africa's population was in "poverty" (less than \$1.90 (adjusted for differences in purchasing power across countries) per capita per day), as was 12 percent of South Asia's twice as large population.

As their incomes start to rise, low-income people spend most of the first increments to income on food. By about \$2 per day per capita income, most people can access

enough calories. As their incomes rise from about \$2 to \$10 per capita per day, most people eat more fruits, vegetables, meat, eggs, dairy products, and edible oils, causing rapid growth in demand for raw agricultural commodities. However, after about \$10 per capita per day, from additional increments in their incomes people tend to buy more processing, services, packaging, variety, and luxury forms, but not more raw agricultural commodities.

To achieve the goal of ending hunger the poverty problem must be solved. However, to the extent we are successful at this, we unleash the most rapid phase of growth in the demand for raw agricultural commodities. This increases the likelihood that the growing demand for food will outstrip the country's agricultural production capacity (unless it can increase agricultural productivity at least as fast). China's experience in recent decades is a prime example of successful poverty reduction being translated into growth in demand for food at a faster pace than domestic production could grow, resulting in China becoming the world's largest agricultural product importer.

The greatest uncertainty in projecting the future demand for food is how many hundreds of millions of low-income people will successfully escape poverty and, in turn, hunger. The United Nations Sustainable Development Goals have a target of eliminating poverty and hunger by 2030, goals that the world was not on track to attain even before COVID-19 set us back further.

For the world markets for food and agricultural commodities to successfully perform their balancing wheel role, there must be rules-of-the-road for trade that keep the flows of trade as fluid as possible. Until the Uruguay Round Agreement (1/1/1995) that created the World Trade Organization (WTO), there were no internationally accepted rules-of-the-road for agricultural trade.

In the Uruguay Round Agreement, the WTO's member countries agreed that whatever assistance an individual country provides to its agricultural sector should be commodity-neutral, i.e. not to distort the natural comparative advantage of any country by creating artificial incentives to advantage production of any one product more than others. Export subsidies were banned in agricultural commodities, as they had been for manufactured goods since 1979. The member countries agreed to convert all nontariff barriers to agricultural imports (e.g. quotas) to tariffs and reduce them over time. They also agreed to cap and reduce production- and trade-distorting agricultural subsidies.

The fraction of world agricultural production moving through international markets has more than doubled in the years since the Uruguay Round Agreement came into effect, to the significant benefit of American farmers. In recent years, the United States

and other countries have backslid on their commitments to freer movement of agricultural products in world trade. Furthermore, the dispute settlement process within the WTO has been rendered ineffective by the unwillingness of the United States to allow new judges to be appointed, a somewhat surprising fact when the U.S. has won more cases than it has lost there.

This session will review the projected growth in international agricultural trade. It will further address the importance of keeping international markets as open as possible so they can play the balancing wheel role that will be needed as consumer demand in certain regions outgrows their agricultural production capacity and as greater variability in climatic conditions caused greater year-to-year fluctuations in individual countries' food production.

Speakers:

Joseph Glauber, *Senior Research Fellow, International Food Policy Research Institute; Former Chief Economist, Department of Agriculture*

Philippa Purser, *Head of Strategy and Global Process, Cargill*

1 – 2 PM: Working Lunch

Discussion continues between members of Congress and scholars on international trade and food security.

2 – 4 PM: Individual Discussions

Members of Congress and scholars meet individually to discuss topics raised during the conference. Scholars available to meet individually with members are Chris Barrett, Catherine Bertini, Robert Paarlberg, Pamela Ronald, Joseph Glauber, Devon Klatell, Tjada D'Oyen McKenna, Catherine Russell, and Rajiv Shah.

7 – 9 PM: Working Dinner

Seating is arranged to expose participants to a diverse range of views and provide the opportunity for a meaningful exchange of ideas. Scholars and lawmakers are rotated daily. Discussion will focus on global malnutrition and international trade and global food security.

FRIDAY, APRIL 14:

8 – 8:55 AM: Breakfast

9 – 11 AM: Roundtable Discussion

Public and Private Investments in Agricultural Research

There are important roles to be played in reducing future food insecurity by investments by both the public and private sectors, as well as by philanthropy. Financial analysis has demonstrated that investments in agricultural research have a high rate of return on investments made by both the public and private sectors.

Public support for agricultural research played a major role in the economic development of American and European agriculture. The resulting technologies were made freely available to all, often pushed out through an extension service which served as a two-way conduit of farmers' problems to researchers and solutions back to farmers.

Historically, public support for agricultural research in the U.S. was much larger than private sector support, however this reversed in the mid-1970s. In recent years there has been a burst of activity in venture capital funds investing in food and agricultural research. Today both the Rockefeller Foundation and the Bill and Melinda Gates Foundation have major commitments to supporting agricultural research in low-income countries. The Gates Foundation was originally focused on health; however, it came to realize that when people are nutritionally compromised, the payoff to health investments is reduced. This recognition brought the Gates Foundation into also investing their philanthropy in agricultural development.

The private sector also played an important role in research on farm machinery, pesticides, and animal pharmaceuticals. To pay for the research (both successes and failures) and to provide a return to owners or shareholders, the resulting technology is embodied in production inputs that farmers buy. This is possible only when the intellectual property resulting from the research can be protected by patents or other "do not reproduce for sale" rules. In recent decades, with increased ability to patent biological materials, the private sector has come to play a much larger role in developing new agricultural technologies embodied in plant seeds than previously. In all cases the sales arms of the private sector companies play important roles in technology transfer to farmers.

Despite the high rate of return on both public and private investments in agricultural research and technology transfer, public support for it has been falling in the United States, Europe, and other high-income countries (in both domestic research and that financed through their foreign aid). Today the governments of both Brazil and China invest more in agricultural research than the United States.

Public support to domestic agricultural research institutions has dropped in recent decades across the high-income countries; the same has happened in their foreign aid. There are many areas of research in which the private sector will invest less than the socially optimum. These include basic research where the payoff is too uncertain or too far in the future, areas in which it is hard to protect the intellectual property resulting from the research or where no market exists, e.g. conservation and public policy. If the potential market is small, it is often difficult for the private sector to justify the investment cost. This is often the case with “orphan crops,” including many fruits and vegetables.

Agricultural technologies often require very specific local agro-ecological conditions (soil and climate), so additional research is often necessary to adapt a crop to the conditions in a specific region. The tools of agricultural science are highly mobile across countries, but individual varieties or breeds often need additional research to optimize them for other locations than their origins. With all agro-ecosystems migrating away from the Equator and the incidence of extreme climatic events increasing, it is going to take more adaptive research just to sustain present productivity levels.

This brings us to the challenge of meeting the agricultural research needs of food-insecure countries which have large numbers of impoverished farmers. Those farmers often lack the purchasing power to access improved seeds even if they are available, or lack sufficient collateral to access credit, even where credit institutions exist.

Frequently today the private sector has better research facilities and scientists to address these challenges than the public sector. Many firms are generous with their philanthropy, but the magnitude of the challenges is far greater than the private sector can be expected to solve on its own. Furthermore, many observers argue that there needs to be a balance between public and private sourcing of new technologies.

To meet future global food demand sustainably will require increases in global food system productivity. Where possible, we will need to make presently unusable soils productive, increase the genetic potential of individual crop and animal species and farming systems in the face of climate change, increase the productivity of the water used, reduce competition from weeds in crop production and parasites in animal production, and reduce post-harvest losses, all in an environmentally benign manner.

Fortunately, we are in the golden age of the biological and information sciences. The tools of modern science give us the potential to:

- Improve the nutritional content of staple foods (augment the deficient vitamins, minerals, and protein);

- Increase tolerance to adverse growing conditions (e.g. drought, temperature, wetness; salt);
- Internalize resistance to insects and diseases to reduce pesticide use;
- Slow down quality deterioration in perishables;
- Increase precision in application of fertilizer nutrients and pest control media

There is huge potential in food science research to enhance future food security. The next frontier includes vertical farming (growing plants in high rise buildings using hydroponics and artificial light), plant-based meats and beverages, cell-cultured meats and milk produced in fermentation vessels, and many others. A big question is whether these can be scaled up sufficiently to bring the unit cost of production down sufficiently to be competitive and provide a sufficient return to investors to attract the necessary capital. Many venture capitalists are betting that this is possible.

With projected population growth and broad-based economic growth and urbanization, which tend to change dietary patterns, the world needs to significantly increase food production using less water and little, if any, more land. The current level of investment is less than necessary for this to happen, much less use some agricultural output as raw material for biofuels. For the world to achieve zero hunger and use agricultural products as feedstocks from which to make biofuels will require a significantly larger investment in productivity-enhancing agricultural research than is occurring at the present.

Anti-technology activists pose one of the greatest threats to global food security today. There is just as great potential for modern biological science to contribute to global food security, particularly in the face of climate change, as to improving human health through medicine, if only it is allowed to be applied.

This session will explore the potential for modern biological and information sciences to contribute to future global food security in a world in which climate is changing and do it in an environmentally benign way.

Speakers:

Pamela Ronald, *Distinguished Professor, Department of Plant Pathology & the Genome Center, University of California, Davis*

Robert Paarlberg, *Associate, Harvard Weatherhead Center; Professor Emeritus of Political Science, Wellesley College*

Erik Fyrwald, *CEO, Syngenta Group*

11 – 11:15 AM: Break

11:15 AM – 1 PM: Roundtable Discussion:
Investments in Rural Development

Emergency feeding programs will always be needed to respond to food insecurity resulting from war, natural disasters and politically imposed famine, however they will never be the solution to the chronic food insecurity experienced by 10 percent of the world's population. To solve chronic food insecurity, a reliable supply of foods that contain enough energy and essential amino acids, vitamins, and minerals to maintain health must be available from local production or markets year around. Availability is the necessary condition for eliminating hunger, but to eliminate hunger people must have sufficient purchasing power to access the available food. Since the extreme poor spend most of their meager incomes on food, the purchasing power of their income is determined mainly by the price of food.

An estimated 75 percent of the extreme poverty in the world is in rural areas, and most of the poor are farmers. The focus here will be on them.

Poverty is the motivation for a great deal of migration of the rural poor to higher income countries, and billions of dollars of the income they earn there get remitted back to their home countries each year. The large number of these migrants working in the U.S. and Europe, both documented and undocumented, has caused a significant political backlash against immigration. Moreover, few low-income country governments have the budgetary capacity or political motivation to make large income transfers to their low-income farmers.

A much more attractive long-term solution is to increase low-income farmers' income from the marketplace. The agricultural sector in many low-income countries is significantly underperforming relative to its potential. Current crop yields fall short of their agronomic potential consistent with economic efficiency and environmental sustainability. In Sub-Saharan Africa, for example, average crop yields are estimated to be only 25 percent of their agronomic potential using presently available technology.

The first means of reducing farmers' poverty is to increase productivity of the crops they are already growing. Next, farmers can change what they are producing to higher value-per-acre crops, e.g. fruits, vegetables, or nuts, or add livestock, poultry or aquaculture, to their product mix. This can have the additional benefit of improving the farm family's nutrition. Farmers may be forced to change what they are growing if local climatic conditions change sufficiently to render the crops they are now growing non-viable in their locality. In either case, the specificity of knowledge related to each new crop or animal species requires education.

Another way to reduce rural poverty is for farmers to acquire more land or other income-generating assets, such as education, in particular literacy, numeracy, and agronomic and animal husbandry skills and management skills to manage a larger farm. There is a finite limit to how much net income can be generated for a farm family from small holdings. In South Asia, for example, the average farm size is one to two acres, and virtually all the potentially arable land is already in production. There are few things that a small farmer can produce on so little land and generate an above-poverty family income. Indeed, this is the reason that in some regions farmers turn to growing poppies or other raw materials for illegal drugs.

Every country that has successfully reduced poverty in agriculture has created non-farm employment opportunities, both locally and further afield, for one or more members of the farm household. Most small farm households which escape poverty earn most of their family incomes from non-farm sources. This is true all over the world.

The next step is for significant numbers to leave farming completely and become employed in the non-farm sector. In fact, in the normal course of economic development, first the fraction of the workforce engaged in farming declines, and eventually their absolute number declines. When this happens, both those who leave and those who stay behind in farming and can gain access to more land have the potential to earn higher incomes. In very low-income countries the fraction of the workforce engaged in farming is often over 50 percent, while in the highest income countries it is in the very low single digits.

The private sector needs to build the agricultural input and product marketing, storage, and processing infrastructures (including cold chain to reduce post-harvest losses of perishables) which are critical to successful agricultural development. The track record of the public sector in these areas is not positive. The best role for the public sector is to define and enforce the rules-of-the-road for investment and commerce.

Only the private sector can create enough jobs to solve the problem of poverty in low-income countries' rural or urban areas, however government needs to provide a positive investment climate before investments of either local or international capital will be made. There must be reasonable macroeconomic and political stability, rule of law, a minimum of corruption, definition and protection of property rights, and enforcement of contracts.

To advance broad-based rural economic development--both agriculture and the rural non-farm economy-- investments in several rural public goods are needed. Here the public sector's role can be beneficially enhanced via official development assistance (foreign aid) and international development bank lending. Investments in rural infrastructure, education, health, and agricultural research and technology transfer are needed to solve the problem of rural poverty through development of agriculture and the rural non-farm sector. It is noteworthy that in the Uruguay Round trade agreement, every country's public sector investment in agricultural research and technology transfer and in rural infrastructure were accepted as public goods and therefore not restricted.

Historically, the governments of many low-income countries have placed low priority on agricultural and rural development in national budget allocations and in their international borrowing. In fact, until recently all low-income regions of the world extracted more tax revenue from their rural areas (usually through export taxes) than they invested in those areas. The balance of political power resides in their cities, even though their farmers often comprise large fractions of their populations. This has been a major impediment to their agricultural development. Today, Sub-Saharan Africa is the only remaining region where the net transfer of funds is away from rural areas.

While foreign aid and international development bank lending placed high priority on agricultural and rural development in the 1970s following a famine in South Asia, it peaked in the mid-1980s, and then went into precipitous decline. It recovered somewhat following the world food price crisis of 2008-10, only to quickly recede again when international agricultural commodity prices returned to more normal levels. The fraction devoted to agricultural research has fallen more than proportionately. The current food price crisis has once again heightened awareness of food insecurity, however, at present the main driver of increased priority on agricultural development has been climate change.

There are no quick fixes to rural poverty and associated hunger or to the underperformance of agriculture relative to its potential in low-income countries. Immense amounts of capital investment will be needed. The capital investment requirements to provide the essential rural public goods (rural roads, agricultural research and extension, and rural education and health services) vastly exceed the capacity of most low-income country governments. This is where foreign aid, lending by international development banks, and philanthropy such as that of the Rockefeller, Eleanor Crook, and Gates foundations can play a critical role in supplementing low-income countries' own resources.

If there is genuine concern about reducing poverty and hunger in low-income countries, their own governments need to provide a positive investment climate so the private sector can do as much as it can. The governments themselves, as well as foreign aid donors and international development banks, must also make and sustain budgetary commitment to agricultural and rural development. On-again off-again funding accomplishes little.

This session will review the roles that need to be played by the public and private sectors to achieve significant reductions in poverty and hunger in the world. Emphasis will be put on rural areas, where the largest concentrations of poverty and hunger exist. The magnitude of the investments needed by the public, private and philanthropic sectors will be discussed.

Speakers:

Strive Masiyiwa, *Founder and Executive Chairman, Econet Global and Cassava Technologies*

Rajiv Shah, *President, The Rockefeller Foundation*

1 – 2 PM: Working Lunch

Discussion continues between members of Congress and scholars on investments in rural development.

2:30 – 2:45 PM: Key Conference Takeaways

Speaker:

Rapporteur **Robert Thompson**, *Senior Fellow, Global Agricultural Development and Food Security, the Chicago Council on Global Affairs; Former Director of Rural Development, the World Bank*

2:45 – 3:15 PM: Policy Reflections (Members of Congress only)

All attendees can remain in the meeting room, however, this session is only for Members of Congress to discuss ideas and policies.

This time is set aside for Members of Congress to reflect on what they learned during the conference and discuss their views on implications for U.S. policy.

7 – 9 PM: Working Dinner

Seating is arranged to expose participants to a diverse range of views and provide the opportunity for a meaningful exchange of ideas. Scholars and lawmakers are rotated daily. Discussion will focus on public and private investments in rural development and agricultural research.

SATURDAY, APRIL 15:

8 AM: Participants depart the hotel for the airport to return to the U.S.

CONFERENCE PARTICIPANTS

MEMBERS OF CONGRESS AND THEIR SPOUSES:

Rep. Jim Baird
and Danise Baird

Rep. Earl Blumenauer
and Margaret Kirkpatrick

Rep. Brendan Boyle
and Jennifer Boyle

Sen. Shelley Moore Capito
and Charles Capito

Sen. Susan Collins
and Thomas Daffron

Sen. Chris Coons
and Annie Coons

Sen. John Cornyn
and Sandy Cornyn

Rep. Diana DeGette

Rep. Rosa DeLauro

Sen. Richard Durbin
and Loretta Durbin

Rep. Ron Estes

**Rep. Jennifer
González-Colón**

Rep. Rick Larsen

Rep. Jim McGovern
and Lisa McGovern

Rep. Chellie Pingree

Rep. Pete Sessions
and Karen Sessions

Rep. Adam Smith
and Sara Smith

Rep. Beth Van Duyne

Sen. Peter Welch
and Margaret Cheney

Sen. Roger Wicker
and Gayle Wicker

SCHOLARS:

Christopher Barrett	<i>Stephen B. & Janice G. Ashley Professor, Dyson School of Applied Economics and Management, and Professor, Brooks School of Public Policy, Cornell University</i>
David Beasley	<i>Former Executive Director, United Nations World Food Programme</i>
Catherine Bertini	<i>Distinguished Fellow, Chicago Council on Global Affairs; Former Executive Director, World Food Programme</i>
Erik Fyrwald	<i>CEO, Syngenta Group</i>
Joseph Glauber	<i>Senior Research Fellow, International Food Policy Research Institute; Former Chief Economist, Department of Agriculture</i>
Devon Klatell	<i>Vice President, Food Initiative, The Rockefeller Foundation</i>
Strive Masiyiwa	<i>Founder and Executive Chairman, Econet Global and Cassava Technologies</i>
Tjada D'Oyen McKenna	<i>CEO, Mercy Corps</i>
Robert Paarlberg	<i>Associate, Harvard Weatherhead Center; Professor Emeritus of Political Science, Wellesley College</i>
Paul Polman	<i>Business Leader; Co-author of "Net Positive"</i>
Philippa Purser	<i>Head of Strategy and Global Process, Cargill</i>
Pamela Ronald	<i>Distinguished Professor, Department of Plant Pathology & the Genome Center, University of California, Davis</i>
Catherine Russell	<i>Executive Director, UNICEF</i>

Rajiv Shah *President, The Rockefeller Foundation*

Máximo Torero Cullen *Chief Economist, Food and Agricultural Organization of the United Nations*

RAPPORTEUR:

Robert Thompson *Senior Fellow, Global Agricultural Development and Food Security, the Chicago Council on Global Affairs; Former Director of Rural Development, the World Bank*

FOUNDATION REPRESENTATIVES:

David Lane *President, Annenberg Foundation Trust; Former United States Ambassador to the United Nations Agencies for Food and Agriculture*

William Moore *CEO, Eleanor Crook Foundation*

Eileen O'Connor *Senior Vice President for Communications, Policy, and Advocacy, The Rockefeller Foundation*

ASPEN INSTITUTE CONGRESSIONAL PROGRAM:

Charlie Dent *Executive Director, Aspen Institute Congressional Program and Vice President, Aspen Institute*
and **Pamela Dent**

Tyler Denton *Deputy Director*

Carrie Rowell *Conference Director*

Jennifer Harthan *Senior Associate, Congressional Engagement*

RAPPORTEUR'S SUMMARY

Robert L. Thompson

Senior Fellow, Chicago Council on Global Affairs

Introduction

Members of Congress met from April 10 to 15, 2023 in Bellagio, Italy for briefings and discussions on strategies to ensure global food security and U.S. policy responses. More than a dozen scholars and experts from the United States and other countries gathered to brief and engage with 20 [KC1] [MOU2] members on the near-term world food price crisis, the crisis of global malnutrition, and the longer-term issue of chronic food insecurity.¹

Participants addressed food security at three levels: global, national, and individual.

Global food security concerns whether the world's farmers can produce enough food containing all the essential nutrients (calories, amino acids, vitamins, and minerals) to feed the world's larger population a more nutritionally adequate diet at reasonable cost without damaging the environment.

National food security concerns the potential for self-sufficiency that is both economically efficient and environmentally sustainable. It is strategically important for every country to have a reliable, safe and nutritious, reasonably priced supply of food through domestic production and international trade (imports minus exports).

Individual food security requires two conditions to be met. The necessary condition is whether there is a safe, reliable, and reasonably priced supply of all essential nutrients **available** from local production or the local market year around. The sufficient condition is whether a given household or an individual has sufficient purchasing power to **access** a nutritionally balanced diet from home-grown sources or the local marketplace.

While war, natural disasters, and politically-imposed famine cause emergency food insecurity, poverty is the primary cause of chronic individual food insecurity, which makes poverty reduction central for minimizing food insecurity. Chronic hunger and

¹ Throughout this document the words "expert(s)" refers to the invited outside experts and scholars, and "member(s)" refers to member of the United States Senate or House of Representatives in attendance. Use of the plural connotes more than one individual, but not consensus. No attribution is made to any individual participant.

food insecurity cannot be eliminated without solving the poverty problem. Seventy percent of the extreme poverty is in rural areas. Most of the rural poor are farmers, the majority of whom are nevertheless net food buyers.

And since the extreme poor spend the largest fraction of their meager incomes on food, the price of food is the most important determinant of their purchasing power.

The World Food Price Crisis

The conference opened with experts reviewing the perfect storm of forces causing the current world food price spike, the third in the last 15 years. They noted that before COVID-19, the world's population was growing by 80 million each year [KC3] [RT4], but an unprecedented rate of poverty reduction, especially in China and East Asia, accelerated growth in demand for food. At the same time, there was rapid growth in the use of agricultural commodities as feedstocks for production of biofuels, both ethanol and biodiesel. For more than two decades before COVID-19, demand for agricultural commodities grew faster than their production.

Experts observed that COVID-19 interrupted food supply chains, with a large swing from food consumed away from home to food consumed at home. Large income transfers in high-income countries in response to COVID-19 sustained consumer purchasing power in the face of supply shortages. More frequent extreme climatic events, particularly droughts and floods, caused localized farm production shortfalls in various parts of the world. In several countries conflict has interrupted farm production and food supply chains. Animal disease outbreaks caused large reductions in pork production in China and egg production in the United States. As their domestic food prices rose, some countries imposed agricultural export restrictions to constrain domestic prices, contributing to upward pressure on world market prices.

On top of these developments, the Russian invasion of Ukraine had a significant impact on global agricultural markets. Experts explained that before the invasion Ukraine and Russia together supplied over one-third of world wheat trade, 75 percent of sunflower oil trade, and significant amounts of corn and barley trade. They were the dominant or exclusive suppliers to many countries in Africa and the Middle East. Economic sanctions imposed on Russia, which is also a major supplier of fertilizers to the world market, also caused dislocations and price increases in the market for fertilizers, which are critical farm production inputs.

Experts noted that while international agricultural commodity prices and transport costs rose throughout 2020 and 2021, commodity prices went down through 2022 into

Strategies to Ensure Global Food Security

2023. Nevertheless, rising wage rates and a generally inflationary environment have contributed to further increases in retail prices of food. Both experts and members observed that the highly concentrated food industry in the U.S. and other high-income countries has been able to use its market power to push prices still higher to increase margins.

Experts noted that because the poor spend the largest fraction of their income on food, they are also hit hardest by increases in food prices. The number of hungry and undernourished has risen from about eight percent of the world's population before COVID-19 to about 10 percent today. Experts further noted that the combination of higher international commodity prices and the strength of the U.S. dollar in which most commodities are priced have made it difficult for heavily indebted low-income countries to sustain their needed volume of food imports.

Experts observed that the international food system has exhibited significant resilience as it responded to the dislocations associated with COVID-19 and the Russian invasion of Ukraine.

Both experts and members acknowledged that the United States and other high-income countries have been extremely generous in funding emergency feeding programs in response to the current crisis. While acknowledging the great generosity of the United States in this area, both experts and members observed that U.S. food aid is much less effective per dollar spent than other countries' food aid. The U.S. is the only country which still provides international food aid in-kind as opposed to in cash.

Experts explained that it is much more efficient to use cash to acquire food for aid as close to the destination as possible to minimize transportation costs. Experts and some members further observed that the cargo preference requirements in the Jones Act siphon off still more of the value of food aid appropriations. Some members commented that the rules on food aid are outdated.

Experts added that some countries have had good experiences with cash transfers to the poor conditional upon their children attending school. When combined with a school feeding program this has delivered measurable improvement in the nutritional status of the children.

Both experts and members observed that extreme poverty and hunger can be the fuse that ignites a social unrest like the Arab Spring. In extreme cases it can lead to mass migrations to refugee camps and across international borders. Experts observed that it is much more expensive to address the problem after refugees have left their home areas. Moreover, legal or illegal immigration of masses of the poor and hungry from

low-income countries leads to political problems in host countries. This discussion motivated several members to observe that the United States Congress still needs an immigration reform. In this context, one member reminded the group that American farmers have a hard time finding enough Americans for farm work, while many migrants have agricultural experience.

Experts observed that, while there is money available for emergency feeding programs, there are very few resources to address the longer-term challenge of developing the capacity and resilience of farm production in the areas receiving food aid. They observed that the amount of foreign aid going into agricultural development has been in decline since the mid-1980s. As one expert put it, “Philanthropy is not a long-term solution.” One member also reminded the group that “If you give a man a fish, you feed him for a day. If you teach a man to fish, you feed him for a lifetime.”

Crisis of Global Malnutrition

Experts began this discussion by characterizing the magnitude and cost of the crisis of malnutrition in the world today, or what one member called the “shocking disconnect between nutrition and health.” Besides absence of disease caused by pathogens, good health requires absence of non-communicable diseases caused by insufficient quantities of essential vitamins, minerals, and amino acids in the diet or by excessive intake of sugar, fat, and salt in the diet.

Experts highlighted that 828 million people in the world suffer from chronic hunger, 160 million children are stunted, and 40 million experience acute malnutrition. These numbers have been tragically increasing due to the spike in food prices. In addition, at least two billion more people suffer from one or more of the noncommunicable nutritional deficiency diseases caused by inadequate intake of vitamins and minerals, in particular vitamin A, iodine, iron, and zinc.

Experts pointed to the diminished productivity of the adult population in low-income countries. This trend stems from the irreversible stunting of physical and brain development that occurs during the first 1,000 days from conception of an infant to the age of two as a result, if the pregnant mother and infant child do not receive adequate nutrition.

While the principal focus of this conference was on the problems of undernutrition in low-income countries, experts also addressed the high costs of treatment of noncommunicable diseases associated with overnutrition, diabetes, and cardiovascular problems, in the United States and increasingly around the world.

Experts addressed solutions to the crisis of malnutrition from three perspectives:

- **availability** of foods that contain all the essential vitamins, minerals and amino acids from local production or the market year-around
- ability of local residents to **access** available supply of those nutrients
- consumers' **knowledge** of nutrition principles to make informed dietary choices.

Concerning **availability**, experts acknowledged the existence in both high- and low-income countries of “food deserts” where foods containing all the essential vitamins, minerals, and amino acids are unavailable locally. Wars, natural disasters, and epidemics like COVID-19, interrupt both farm production and supply chains.

Experts observed that cereal grains, the primary sources of carbohydrates in the human diet, are deficient in various vitamins, minerals, and amino acids. Yet, they are the agricultural commodities which have enjoyed the largest production subsidies and public investments in productivity-enhancing research. This has resulted in a long-term downward trend in the price of cereal grains relative to more nutrient-dense fruits, vegetables, and animal protein. While the private sector has taken over a great deal of production research on cereal grains, oilseeds, and cotton, many fruits and vegetables get passed over as “orphan crops,” since the potential market for research is too small to justify the investment.

Experts and members further noted that U.S. farm support payments and production subsidies have been focused on cereal grain, oilseed, cotton, and sugar production, not on nutrient dense foods (except milk). Furthermore, since farmers receive crop support payments based on their historical acreage planted to specific crops, protection of the base can motivate farmers to keep growing those crops even if fruits or vegetables might otherwise be more profitable. Both experts and members asked whether a more nutritious outcome from our food system could be obtained by repurposing some of the research and production support towards more nutrient dense commodities.

Experts also pointed out that the research tools of modern biology make it possible to increase the nutritional content of cereal grains. For example, rice, which contains no vitamin A, is the principal component of the diet of several billion people in Asia. As a result, hundreds of thousands of people there suffer blindness and shorter lives due to vitamin A deficiency. More than 10 years ago, Swiss scientists using genetic engineering inserted a gene into rice giving it higher vitamin A content, thereby creating the potential to save innumerable people from blindness. Nevertheless, anti-science NGOs have blocked the commercial production of “golden rice.”

Experts added that the gene editing tool CRISPR/Cas9 opens up even greater potential to enhance the nutritional content of staples on which billions of people live. If scientists are allowed to use them, farmers are allowed to grow the resulting varieties, and consumers are willing to eat them. They noted that there are well-funded anti-science NGOs waging a public opinion campaign against their use.

Experts added that post-harvest losses are particularly high in nutrient dense foods, especially fruits, milk, meat, and fish, which are highly perishable. This is particularly problematic in low-income countries where there is a lack of refrigerated storage and transport.

Turning to the ability to **access** available supplies, experts explained that poverty is the primary cause of chronic hunger and undernutrition, and since the poor spend a large fraction of their incomes on food, the food price spike has significantly reduced their purchasing power.

Both members and experts acknowledged the significant contribution made by SNAP, WIC and the school lunch program in the United States to reducing poverty-caused hunger. Some participants pointed out that the rules concerning what foods may be purchased with SNAP benefits could be much more effectively used to guide consumers towards better nutrition decisions. For example, they suggested that the purchase of sugary beverages and ultra-processed foods containing little more than sugar, salt and fat should not be allowed under SNAP.

The experts further noted that the successful school feeding programs in several low-income countries have the attractive additional benefit of keeping more children, especially girls, in school. Members also observed dual benefits from schools having vegetable gardens to teach students where food comes from and expose them to nutrient-dense foods, they eat produce from their own school garden.

Experts noted that distribution of dietary supplements is a cost-effective means of improving diets where foods containing all the essential nutrients are not available. Both members and experts noted that in cases of severe malnutrition, products such as “Plumpy’Nut” have proven effective at rescuing children in the throes of starvation. When members asked experts how to prioritize nutrition work in low-income countries, the swift answer from experts was “mommies and babies.”

Recognizing that non-communicable diseases caused by either over- or under-nutrition impose significant costs of society, experts discussed the concept of “food as medicine,” in which medical practitioners might prescribe foods containing the needed vitamins, minerals, and amino acids. Experts and members debated the ability of Medicare and

Medicaid and the willingness of insurance companies to shoulder this additional demand on their resources. Noting that CBO does not score negative health outcomes, some members questioned whether insurance companies would see potentially lower future claims as offsetting larger near-term outlays for more nutritious diets.

Experts pointed out that the failure of many people to access available nutrient-dense foods and to follow good nutritional practices, such as breastfeeding, reflects a lack of **knowledge** of the health benefits. Experts noted that the internet provides a great deal of misinformation concerning nutrition, and members observed that two of the historically important vehicles for distributing nutrition information in the U.S., home economics classes in high schools and home economics extension agents, have been discontinued in many locations. Furthermore, experts noted that while medical doctors are a primary source of nutrition advice, few medical schools include a course on nutrition in their curricula for training future doctors. Members further noted how politicized the periodic updating of dietary guidelines has become, including attempts to include non-nutritional criteria.

Experts pointed out that promotion of organic foods raises the cost of food to consumers without scientifically documented nutritional nor environmental benefits. When asked what differentiates “organic foods,” one expert responded “marketing.” Another suggested that it was unfortunate when low-income mothers are shamed into buying more expensive organic foods for their children when there are no scientifically documented health benefits.

Both experts and members observed that food companies produce and sell a lot of highly processed food products with added sugar, salt, and fat that provide little nutritional content other than calories and contribute to the obesity epidemic in the U.S. and around the world.

Finally, experts and members suggested that the NIH, which spends very little of its research budget on nutrition, should increase its work in this area. While NIH devotes significant resources to research on noncommunicable diseases associated with overnutrition, it supports little research on non-communicable diseases that result from under-consumption of essential vitamins, minerals and amino acids. Experts and members called for sustaining the full budgetary commitment to the McGovern-Dole Food for Education Program and the Bill Emerson Humanitarian Trust.

International Trade and Food Security

What agricultural products each country can produce is constrained by its natural endowments of water, soils, and the climatic conditions above them. Every country's government aspires for it to be as self-sufficient as consistent with economic realities and environmental sustainability. However, contrary to calls for "food sovereignty," it is neither economically efficient nor environmentally sustainable for any country to attempt to be self-sufficient in everything. As one member put it, "Grow food where it grows best."

Experts pointed out that about 75 percent of world agricultural production is consumed within the countries where it is grown. Nevertheless, since the creation of the World Trade Organization (WTO) in 1995, the volume of agricultural trade has doubled and its value tripled, with some significant shifts in the geography of world agricultural trade. With rapid poverty reduction in China, its food consumption grew faster than production to the point that it is now the world's largest agricultural product importer. The United States gave up its position as the largest supplier of corn to the world market to use it instead in ethanol production. Brazil has become the world's largest soybean exporter and more recently a significant corn exporter. Russia and Ukraine have gone from being net agricultural importers to significant exporters of wheat and feed grains. Developing countries have significantly increased their involvement in international agricultural trade as both importers and exporters.

Experts noted that international trade has a critical role to play in ensuring global food security in the future. Trade plays a significant balancing wheel role in national food supplies as weather conditions from year to year affect the volume of food production differently in different countries. This role of trade is becoming even more important now that global climate change is increasing the frequency of extreme climatic events like droughts and floods that cause large year-to-year changes in a country's food production. Some countries will have to change what crops they are growing if climatic conditions change so much that adaptation is not possible within the same crop(s) that a country traditionally produced.

Experts argued that for the world market to play its balancing wheel role, international trade needs to be kept as open and free flowing as possible. To this end, there need to be universally accepted rules of the road for international trade in agricultural products. The Uruguay Round Agreement that created the WTO at the beginning of 1995 codified for the first time a set of internationally accepted rules of the road for international agricultural trade. The United States was a primary author of these rules which were unanimously agreed to by the WTO member countries.

Under these rules the volume of world agricultural trade has doubled, however there has been backsliding in adherence to the rules, particularly when it comes to domestic agricultural supports. Many developing countries have increased their trade-distorting support to agriculture. The European Union shifted its support to agriculture to non-trade distorting land payments. The United States, a primary advocate for replacing trade-distorting agricultural supports with non-trade-distorting forms, has reverted to payments more closely linked to current production and market prices of specific crops. Several countries have imposed non-tariff barriers on agricultural commodity exports to contain domestic price increases, but pushing world market prices higher as a result.

Experts pointed out that it is virtually impossible to agree on greater discipline on agricultural supports short of full multilateral negotiations. They noted that there is just not enough leverage in bilateral or regional trade negotiations. Both members and experts pointed out that with the growth of WTO membership to 164 countries each with veto power it has become virtually impossible to reach full multilateral agreement on anything. Nevertheless, experts noted that the WTO allows plurilateral negotiations among subsets of like-minded countries, particularly on commodity-specific issues.

Experts noted that Trade Adjustment Assistance (TAA) as practiced by the United States has never been very satisfactory despite the economic argument that the gains of the gainers from trade liberalization exceed the losses of the losers and therefore society can afford to compensate the losers for their losses and still come out ahead. Members noted that no industry wants to acquiesce in being downsized even with compensation. Other members argued that we should not give up on TAA.

In general, members argued that trade policy issues are “difficult” to “poisonous” to handle in today’s environment. Members noted that including labor standards more explicitly in trade agreements has helped in this regard. One member argued that Americans would be more supportive of “trade agreements among equals,” suggesting they are unimpressed with the potential benefits from trade agreements between the U.S. and small developing countries.

Both experts and members expressed concern that the United States continues to block appointment of new judges to the WTO’s Appellate Body, which in effect serves as the supreme court of international trade law. Experts and members noted that without the Appellate Body, trade disputes taken to the WTO cannot be resolved to the point of extracting compensation from a country that loses a case and refuses to change the trade policy found to be in violation of international trade law. Experts noted that the U.S. opposition is particularly surprising in light of the fact that the U.S. has won 85 percent of the cases taken to the WTO against it. Members reminded the group that the chief

grievance of the United States has been the tendency of judges in the past to establish case law by ruling beyond the narrow terms of the specific case in front of them.

Experts and members noted that there is a trade issue arising in which the world will need a functioning WTO. With the growing concern about the increasing concentration of greenhouse gasses in the atmosphere, a number of countries, particularly in Europe, are proposing carbon taxes on goods that move through international trade. Great concern was registered that there be internationally agreed upon measurement techniques before such taxes are implemented. It was suggested that there needs to be an international standard-setting body like Codex Alimentarius and that a well-functioning WTO will be needed to adjudicate the inevitable disputes that will arise.

Both experts and some members observed that the United States' competitors are actively engaged in negotiating international trade agreements which create more favored market access for their suppliers relative to U.S. suppliers. One member observed that, "USTR is spectacularly unresponsive" to concerns about foreign market access.

Both experts and members noted that it is particularly important to global food security for the Black Sea Grain Initiative to be sustained to keep grain exports flowing from Black Sea ports to their developing country destinations. It was also suggested that the African and Middle Eastern countries that are heavily or totally dependent on Ukraine and/or Russia for their grain and fertilizer imports should diversify their sources of supply as a risk reduction strategy.

Members pointed out that Sub-Saharan Africa is a large region made up of 48 different countries with heterogeneous natural conditions and that it would benefit from much more open agricultural trade among the member countries. One member reminded the group that the African Growth and Opportunity Act (AGOA) will need to be reauthorized before it expires in 2025.

Several members indicated that they need to receive more stories telling of the benefits of trade and of the potential for TAA to neutralize political opposition to trade agreements. They receive plenty of reports of the negative consequences of trade policy on specific communities and industries, but few positive stories.

Global Food Security

At the global level the food security question is whether the world's farmers can produce enough agricultural products containing all of the nutrients necessary for health of the world's larger future population at reasonable cost. To accomplish this, experts emphasized that farm production must be both economically and environmentally sustainable.

Resource Constraints

Experts explained that the bulk of food production in low-income countries occurs on small farms with family members providing the bulk of labor. In effect, a family farm is a small business with the household's income being the revenue from product sales net of cash costs of production plus the value of whatever products are consumed within the household. Women often play a major role in both the labor and the management of the farm operation.

Experts added that poverty is widespread among small farmers in low-income countries and that outmigration to cities or across international borders is motivated by desire for a better life, at least for their children. To ensure future food security farming has to be profitable enough to retain today's farmers and attract the next generation, many of whom perceive farming as drudgery and local village life as unexciting. Where the opportunity exists, one or more members of most small farm households augment what they can earn in farming with some form of non-farm income either nearby or far away from which they send back remittances. Some members asked how to overcome the perception in low-income countries that the agricultural sector is backward and unsophisticated and to be a farmer is to be destined to a life of poverty.

In general, the low productivity levels in low-income country farming means it is contributing less than it could to the farm families' incomes and to their national food supply, even using presently available technologies. Experts argued that the first step in addressing rural poverty and to increasing a country's domestic food supply is to boost the productivity of available crops or livestock. The next step is to shift at least part of the farm's resources to growing higher value products like fruits, vegetables, dairy, livestock, and poultry. Producing nutrient-dense commodities can have the additional benefit of improving the household's nutrition.

Experts noted that farming is an inherently risky business with crop yields heavily dependent on the weather conditions that prevail within each growing season and on unpredictable farm product prices. Diversification of income from producing a mix of

crops, livestock and/or poultry, and non-farm income is an effective household income risk management strategy.

The amount of land at a farmer's disposal constrains his/her earning potential. If a farmer can gain access to more land and has the skills and labor (or machinery) necessary to manage it, it opens the potential for higher household income. In parts of South America and Sub-Saharan Africa there is some more land that can be brought into cultivation. In East and South Asia virtually all arable farmland is already in production, so for some farmers to gain more land, others need to exit farming. Where there are non-farm employment opportunities, this creates the possibility for both those who leave and those who stay behind in farming to earn higher incomes.

Experts emphasized that there is relatively little additional arable land available in the world that is not presently forested. Destruction of forests to expand the area in agricultural production destroys wildlife habitat, biodiversity and carbon-sequestration capacity, all unacceptable environmental outcomes.

Acknowledging the urgency of increasing food production to feed the world's growing population a more nutritious diet, experts argued that this should be accomplished through boosting the productivity on lands already in production. This will help avoid further destruction of forests to expand cropland or grazing land. Both experts and members called for rehabilitation of degraded soils that have productive potential.

In addition to human resources and land, the third essential resource for agriculture is fresh water. Experts reminded those assembled that countries vary greatly in the amount and reliability of precipitation and the presence or absence of rivers and ground water. It is estimated that farmers account for 70 percent of the global freshwater use in their irrigation. Moreover, as experts pointed out, with 70 percent of the world's population projected to live in cities by 2050, cities are already outbidding farmers for available fresh water in some places. Future expansion of global food production will likely have to be accomplished using less total water than today. It will be necessary to increase the food production per unit of water used in farming in many parts of the world.

Both members and experts gave particular attention to the agricultural production potential of Sub-Saharan Africa. This is of particular concern because Sub-Saharan Africa is the one region of the world projected to almost double its population in the next three decades, and a number of countries in the region are experiencing faster economic growth and rapid urbanization. As a result, demand for food in the region is growing rapidly. Experts admonished the group that this is a large and heterogeneous region for which no 'one size fits all' prescription can be applied to its agricultural development.

Today Sub-Saharan Africa is a net importer of food, yet experts suggested that there is no reason the region could not be self-sufficient in food today or in the future. Experts estimate that the region's agricultural production is only 25 percent of its potential. They noted that the region has at least 60 percent of the global potential for expanding the area in crop production without destroying forests. Furthermore, while large aquifers have been discovered under a number of countries in the region, very little of Sub-Saharan Africa's irrigation potential has been developed. Experts observed, however, that Sub-Saharan Africa has severely degraded soils, and significant investments will be necessary in rehabilitating those soils to achieve their agricultural potential. Successfully rebuilding the organic matter content of Africa's soils would result in a huge increase in global agriculture's carbon sequestration.

Experts observed that Sub-Saharan Africa is the region of the world in which government policy is least favorable to agricultural development. Public policy in many countries turns the terms of trade against their farmers, and the governments invest little in the necessary infrastructure to enable rural economic development. In 2003 African heads of state pledged to devote 10 percent of their national budgets to agriculture and food security (Maputo Declaration), but few have honored their commitment, with most lying in the low single digits. One expert suggested that, "Agriculture is low hanging fruit" in Sub-Saharan Africa, yet most African governments invest little of their own resources in agricultural and rural economic development.

Climate Change

Both experts and members addressed the challenges posed to future food security by climate change. Experts registered concern that climate change has reduced the rate of productivity growth in agriculture by around 30 percent. (Productivity is still growing, but at a slower rate than previously).

Experts pointed out that the world is warming more over land than over water and more at the high latitudes than at the equator. All agro-climatic zones are shifting a few degrees latitude away from the equator, with growing seasons becoming longer in the high latitudes. Precipitation patterns are changing, often with more intense downpours and increased runoff. Some regions, like the U.S. Southwest, Central America, and the Mediterranean Basin are becoming drier. Extreme climatic events such as hurricanes, droughts and floods, are becoming more frequent. Experts argued that some of the most food insecure countries are being impacted the most by climate change.

Experts explained that global warming is occurring as a result of increased concentration of carbon dioxide and other greenhouse gasses in the atmosphere. The

increased concentration of carbon dioxide enhances crop production, but climate change brings a number of negative consequences for agriculture. They pointed out that a proliferation of crop pests accompanies rising temperatures. Sea-level rise will rob some countries of farmland. More intense downpours will increase soil erosion and nutrient runoff. Increased variability of when and if precipitation occurs will be an additional source of risk in crop production, which may require additional investment in irrigation where a source of fresh water exists.

Experts argued that agriculture everywhere is going to need to adjust to the changes in climatic conditions. It will be hard to sustain present productivity levels without adaptation to changed climatic conditions. Experts and members noted the need to breed greater resilience into the varieties available to farmers. In some places, climatic conditions may change so much that it will be necessary for farmers to change what crops they are growing.

Experts explained that while agriculture will have to adjust to the changing climatic conditions, it is also important to recognize that agriculture and the food system also contribute to global warming. It is estimated that farm production contributes about 12 percent of global greenhouse gas emissions (in carbon dioxide equivalents) and the rest of the food system (what happens off the farm) adds another 18 percent.

While crop production withdraws large amounts of carbon dioxide from the atmosphere in photosynthesis, agricultural production releases two greenhouse gasses which have a much more powerful effect on global warming than carbon dioxide, methane (from ruminant livestock, rice paddies and manure) and nitrous oxide (from breakdown of nitrogenous compounds in the soil). The entire food system is being called upon to reduce its greenhouse gas emissions and to remove as much carbon as possible from the atmosphere. Experts pointed out that high productivity agriculture provides an additional benefit, reducing the amount of greenhouse gasses released per unit of production. For example, the same number of cows producing twice as much milk can cut the methane emissions per quart of milk produced by half.

While it is important where possible to reduce the greenhouse gas emissions from the farm sector and food system, in low-income countries with food crises, experts recommended that food production needs to be the priority, particularly production of more nutrient dense commodities like fruits, vegetables, and animal products.

One member expressed frustration that many American farmers, even if they accept that climate is changing, refuse to accept that human activity including their own can be contributing to global warming.

Farming Systems

Experts explained that agricultural production is specific to a given location with its unique soils and climatic conditions. The soil is a complex mixture of minerals, organic matter, and microorganisms. Organic matter enhances the soil's capacity to hold water and the chemical nutrients essential for plant growth, nitrogen, phosphorous, potassium, and micronutrients.

Experts explained that all plant growth starts with genetic potential embodied in the seed. The genetic potential embodied in the seed of traditional varieties grown by farmers in low-income countries generally reflects seed selection by the farmers in a locality over generations. Experts explained that this generally gives a fairly low, but reliable, yield consistent with the local soils and climatic conditions. Traditional farmers generally save seed from one cropping season to the next.

Today in most countries seeds with much higher potential productivity are available from public and private sources. These seeds have been improved through plant breeding or other tools of biotechnology, e.g. genetic engineering and gene editing, often optimized for quite narrow regional soil and climatic conditions.

How much of the genetic potential of any seed is achieved depends on climatic conditions within each growing season and the adequacy of the supply of the water and essential chemical nutrients available in the root zone of the plant when the plant needs them. Competition from weeds for water and nutrients reduces the crop yield achieved relative to its potential, as do attacks by insects and plant diseases. The role of any farming system is to minimize the detrimental impact of these detractors from the genetic potential embodied in the seed by controlling insects and weeds and ensuring an adequate supply of plant nutrients when the plant needs them.²

While decaying organic matter in the soil releases nutrients that feed the growing plants, this rarely provides sufficient nutrients to achieve high productivity. If insufficient quantities of any one of the essential chemical nutrients is available in the soil, it reduces the realized yield relative to its potential. Therefore, experts explained it is usually necessary to supplement the organic matter in the soil with enough chemical fertilizers to enable the crop to reach its full potential. Applying more than that can lead to runoff of nutrients into streams, leading to off-site pollution, or percolation down into

² Similarly, in the case of animal agriculture, the genetic potential is embodied in the egg. To achieve that genetic potential the animal must be fed all of the essential nutrients (calories, vitamins, minerals, and amino acids) and the animal needs to be kept disease free and free of parasites that compete for the nutrients ingested.

the groundwater. In either case, it reflects wasted money and bad environmental practice.

Weeds compete with the crop being produced for plant nutrients and sunlight, reducing potential yields. In traditional farming weeds are controlled by manually hoeing or by mechanical cultivation. The introduction of chemical herbicides in traditional farming reduces the amount of labor required for weed control. Control of some insect pests can be achieved through biological controls; others require chemical insecticides. Good farm managers attempt to use only the minimum required to control the target pests and achieve potential crop yields. As in the case of fertilizer, to apply more than the minimum necessary to achieve the objective is both bad economics and bad environmental practice.

Some highly sophisticated equipment, often using geo-positioning tools, has been developed to precisely apply agricultural chemicals where and when they are needed by the crop being produced, even adjusting application rates in response to differing conditions within the same field. This is known as ‘precision farming.’

Modern farming is a high-tech, science-intensive industry. Experts explained that U.S. agricultural production today is three times larger than at the end of World War II with less land and no more inputs used in its production.

Experts explained that good stewardship of the soil by farmers is essential for their economic sustainability. It is also important for the environment. Good stewardship includes managing the soil in a manner that minimizes soil loss through wind or water erosion, minimizes nutrient runoff, and maintains as much organic matter and microbial activity as possible in the soil. Good conservation practice often includes crop rotation, frequently including nitrogen-fixing crops, and rehabilitating soils whose organic matter content or fertility level has been drawn down by intensive cropping.

Traditional standard practice in crop production was to first plow the soil and then loosen it up to a fine texture before planting the seed. Experts explained that this had the unfortunate effect of causing the loss of both soil moisture and organic matter. In the last several decades many farmers in North America, Brazil, and Australia have gone to a system of ‘low till’ or ‘no till’ farming in which the seeds are planted directly into the undisturbed soil surface. In addition, farmers are encouraged to plant a cover crop after harvest to protect the soil from erosion and to increase soil organic matter during the off-season.

Farmers generally view these as good soil conservation practices. In recent years with the increasing concern about minimizing the environmental footprint of agriculture and

sequestering as much carbon in the soil as possible, these practices have become known as ‘regenerative’ practices. In general, farmers embrace the environmental objectives of regenerative practices, but ever conscious of their bottom line, some remain hesitant to fully embrace all of the recommended practices until/unless they are convinced that any increase in the cost they incur is more than compensated by increased profitability. Various compensation schemes are being developed and implemented to compensate farmers for incurring additional cost to sequester more carbon in their soil and provide other “ecosystem services” such as biodiversity and water quality protection.

Experts explained that some advocates of “regenerative agriculture” insist that it must be “organic.” Organic farming relies solely on decaying organic matter to supply the chemical nutrients needed for plant growth. Supplementing this with chemical fertilizers is not allowed, even though decaying organic matter is unlikely to release enough nutrients to achieve the full productivity potential embodied in the seeds of high-yielding varieties. Organic farming uses no chemical pesticides to control insects or weeds; it controls insects by biological controls and weeds by mechanical means.

Experts pointed out that the official definition of ‘organic’ products is a political definition. In addition to banning the use of chemical fertilizers and pesticides, organic farmers are not allowed to plant any seed varieties that are the product of genetic engineering, although they do allow mutations introduced by treating seeds with chemicals or radiation. Some chemical means of controlling pests, e.g. copper sulfate and sulfur, are actually permitted. In general, organic crop yields are lower and production is more labor intensive than when chemical fertilizers and pesticides are used.

Experts pointed out that there is no scientific evidence that organic products are either more or less safe than conventional production for human health or the environment. Nevertheless, several members reminded the group that because some consumers feel organic products are better for them or the environment, they are willing to pay a premium for them. Members noted that, by differentiating their products in this way, producing organics often affords small farmers higher earning potential. Experts noted that the market for organic products is a niche market, and organics can command a higher price to cover the higher cost of production only as long as the niche does not fill. Once the niche is full, additional organic produce can be sold only at the conventional price.

Experts explained that the term ‘regenerative agriculture’ has been embraced by so many interests today that the term has lost its usefulness. Some activists argue that to be truly ‘regenerative,’ agriculture must embrace multiple cropping, ‘rewilding’ of landscapes with their native species of plants and wildlife, and even righting wrongs

imposed on indigenous peoples of the area. One expert cautioned that the term has simply become “too big a tent.” Several participants stated that they hesitate to use the term because it connotes so many different things to different people.

Experts noted that some well-funded anti-science NGOs, including some which receive funding from the European Union and some European country governments, actively lobby and distribute misinformation against science-intensive agriculture. They promote public- and government-opposition to use of genetically engineered crops and chemical fertilizers and pesticides in Sub-Saharan Africa and other developing countries. Experts and members observed that the European Union’s new Common Agricultural Policy goal is to expand organic agriculture to 25 percent of EU agricultural production.

Experts noted that the ban on use of seed developed via genetic engineering is particularly harmful to the future of organic agriculture because the rate of genetic progress is so much faster using all the tools of modern biology rather than only classical plant breeding which is much slower and less precise. Experts observed that application of genetic engineering to conventional crop production has enabled significant reduction in chemical pesticide use in the crops where it has been used.

Experts and members noted that the debate about the appropriate farming systems to promote in low-income countries has unfortunately become highly polemical, often with recommendations having little basis in science. Experts also observed that the politicization of approaches to agricultural development has become a significant barrier to success, with “too many recommendations based on no science.”

Experts and members also discussed the potential for producing food in the future without land. ‘Vertical farming’ using hydroponics to produce specialty crops for high end markets has attracted large investments of venture capital, but it has had mixed success so far with a number of recent bankruptcies. A major handicap appears to be the high cost of energy to replace natural sunlight with artificial light. One expert argued that low-cost electricity from renewable sources may be necessary before much success can be expected in this area.

Both experts and members expressed great concern about the estimated one-third of world food production that is lost between the farm and consumption. In low-income countries the largest losses occur between the farm and retail due to poor storage and transport infrastructure. Experts noted that the losses are particularly severe in nutrient dense food products which are highly perishable at ambient temperature, e.g. milk, fruits, vegetables, meat and fish. Little progress can be expected in increasing the

availability and consumption of nutrient-dense food without refrigerated storage and transport.

Another concern about global food security raised by both experts and members is the growing use of agricultural commodities as feedstocks in production of biofuels, both ethanol and biodiesel. While global corn and sugarcane production have increased along with blending of ethanol into gasoline, the mandates for blending biodiesel have clearly put upward pressure on world market prices of edible oils during the current world food price crisis. Some experts and members questioned the compatibility between the growth in biofuels use and future global food security, although some suggested that the growing use of electric vehicles may relieve some of that pressure.

Both experts and members observed that USAID and the World Bank have significantly reduced their commitments to agricultural development in low-income countries. Experts also observed that, despite the majority of their poverty being in rural areas, many low-income countries themselves devote few resources to developing their own agricultural production capacity.

A number of experts and members noted that USAID's programming is rigidly in silos that make it difficult to access resources for developing agricultural production capacity. One member observed, "USAID is not committed to agricultural production." Another member acknowledged that the "silos" at USAID are often imposed on it by Congress via rigidities in appropriations language. It is up to Congress to instruct USAID to up the priority on agricultural development.

A number of experts and members called for increasing appropriations for Feed the Future and the Millennium Challenge Corporation to increase the number of countries where they can work. They argued for more emphasis on building longer-term farm production capacity relative to emergency feeding programs. They also noted, however, that local governments in the target countries need to step up their game and commit more of their own resources to achieving the shared objectives.

Some members noted that, while the current budget environment is difficult, more resources to work on the resilience of agricultural production may be available under the rubric of addressing climate change. Several members reminded the group that the farm bill is up for renewal this year.

Several members stated that Members of Congress need to see more examples of successful practices in agricultural development programs; they receive complaints about spending on foreign aid, but do not hear enough success stories. Experts

reminded members that there are no quick fixes in agricultural development and that continuity of support is essential.

Public and Private Investments in Agricultural Research

Experts reminded the participants that all foods eaten today have been genetically modified from their ancient precursors by mutations, selection by farmers down through the ages, and breeding since the time of Mendel. They emphasized that the only way to feed the world's larger future population a more nutritious diet at reasonable cost without damaging the environment is through 'science-intensive agriculture.' They added that fortunately we are in the golden age of the biological and information sciences which provide powerful tools to address the challenges posed by climate change to ensure future global food security.

Experts noted the great contribution that public support for agricultural research and technology transfer played in the agricultural development of the United States. Research results were made freely available in the public domain, reinforced by the agricultural extension service which served as a conduit for technology transfer to farmers and of problems of farmers back to researchers.

Experts reported that financial analyses of the return on investment in agricultural research consistently show rates of return of over 30 percent per year. By reducing the cost of food, productivity-enhancing research has had a particularly progressive income distribution effect since it is the poor who spend the largest fraction of their income on food. The poor benefit disproportionately when the cost of food production declines.

Experts observed that despite its demonstrated high rate of return on investment, public support for agricultural research in the United States has declined by one-third since its peak, while public support for research sponsored by the National Science Foundation and National Institutes of Health has risen. Brazil and China both now invest more public resources in agricultural research than the United States.

While support for domestic agricultural research dropped, U.S. support for agricultural research in its foreign aid has dropped even more. Over the years the United States has been one of the largest contributors to the budget of the Consultative Group on International Agricultural Research (CGIAR). The fifteen international agricultural research centers of CGIAR have played major roles in developing technological support for agricultural development in low-income countries through their national agricultural research systems.

Experts noted that with the decline in public support for agricultural research, the private sector has taken over more of the research, particularly in genetics. Instead of taxpayers underwriting the cost of the research, farmers pay for the research in the price of inputs that embody the research results. Experts noted that while some farmers grouse about the cost of production inputs, they cannot have it both ways. If the private sector is going to conduct the research, it has to recoup the cost of the research (and provide a return to its shareholders) in the price of inputs it sells to farmers.

Both members and experts contributed to the discussion of the relative roles of the public and private sectors in addressing world food security. To make its business model work, the private sector has to protect the intellectual property that results from its research and is embodied in seeds or other inputs it sells to farmers. Both members and experts acknowledged that the private sector has made some great technological breakthroughs in production of crops widely grown by farmers in medium- to high-income countries, especially corn, soybeans, and cotton.

Experts acknowledged that these varieties are widely grown by farmers because, despite having to pay for the research in the price of the seed and buy new seed every year, the genetically engineered crops are more profitable to grow than alternative varieties. At the same time, many biotechnology innovations have provided significant environmental benefits by enabling significant reduction in pesticide and fuel use in crop production.

Experts observed that while the private sector's agricultural research is making great technological contributions, public support is still needed in many areas. . There are many minor or 'orphan' crops including many fruits and vegetables that will not attract private sector investment since the market for the products of the research are simply not large enough to cover the research cost. In addition, the potential payoff from basic research is often too far in the future or too uncertain to attract the private sector to undertake it. Further, there are many research areas in which the research is unlikely to result in a product which the firm can sell to farmers to recoup the cost of doing the research, e.g. conservation and public policy. It is also essential for universities to be engaged in biotechnology research to train the next generation of Ph.D. scientists.

Experts pointed out that the public often perceives biotechnologies to be the product of only the private sector, not understanding the distinction between the research tools and who could afford to use them. There is no reason that publicly supported laboratories could not be utilizing the same research tools as the private sector if it could afford them. Early on, the cost of doing this research was very high, and in many cases the private sector had better research facilities than publicly supported agricultural research institutions could afford. Experts also noted that the cost of gene mapping and

biotechnology research has fallen significantly in recent years. They pointed out that, in fact, it was publicly supported basic research that developed CRISPR-Cas9 gene editing.

Experts noted the incredible power of gene editing to address a broad array of today's research challenges. They observed that the tools of modern biotechnology offer exciting new approaches for achieving the goals of regenerative/conservation agriculture including protecting the soil, reducing greenhouse gas emissions, and sequestering carbon. One expert described the potential to optimize root system architecture and the associated microbiome to enhance carbon sequestration.

Nevertheless, both members and experts acknowledged the challenge of using the tools of modern biology to solve global food security problems when there is an active campaign of disinformation against applying those research tools in agriculture. They noted that the European Union, Russia and some Western European governments contribute to the anti-science NGOs carrying out this campaign. They noted that this anti-science campaign has been particularly effective in Sub-Saharan Africa, where some of the greatest food security challenges reside.

Several members asked what it would take to induce the private sector to address more of the world food security concerns in low-income countries where farmers lack resources to pay for the research in the price of inputs, and the countries themselves may be foreign exchange-constrained due to heavy loads of international debt. Experts noted that in some cases companies have been generous in making research tools available without royalties, and in other cases companies have entered into public-private partnerships with foreign aid or foundation support to use their research capabilities to solve developing country problems without the results having to be sold inclusive of royalty. Some members asked if there might be ways to induce the private sector to engage in these areas via patent policy as was done with pharmaceutical companies in Africa during the COVID-19 pandemic.

Both experts and members participated in a rich discussion of research needs in support of global food security:

A recurring theme by both experts and members was the lack of data on carbon sequestration in the soil associated with alternative production practices and concern that a lot of recommendations to farmers today are made with weak scientific basis. Both called for basing compensation to farmers for carbon sequestration on outcomes, not production practices, noting that more research will be needed before this is possible.

One area that received particular attention is research that would bring down the consumer cost of nutrient-dense foods like fruits and vegetables relative to cereal grains. Several mentioned research to reduce large post-harvest losses due to the perishability, particularly of fruits. Others suggested engineering research to reduce the labor-intensity of producing fruits and vegetables. Some mentioned biotechnology research to reduce the incidence of plant diseases and losses to insects. Others noted the potential through biotechnology to enhance the nutritional content of cereal grains.

A common theme in the research discussion was the need to increase resilience of crops to the more frequent occurrence of climatic extremes. It is essential, they argued, to breed into crops greater resilience to extreme temperatures and precipitation (high and low). Experts reminded that adaptive plant breeding is necessary to optimize crops for local agro-climatic conditions and that, as those conditions change, it is going to require more adaptive research just to sustain present productivity, not to mention breeding in greater resiliency.

Both members and experts noted that, with the increasing competition for fresh water from urbanization, it is going to be essential for agriculture to increase the efficiency with which it uses fresh water. They suggested this to involve both increasing the efficiency with which irrigation water is delivered to crops and very basic plant science research to increase the efficiency with which the plant itself uses water.

Acknowledging that progress has been made in precision application of fertilizers and pesticides, experts and members argued for more research on ‘just-in-time’ delivery of enough pesticides and of fertilizer nutrients deliver to plant roots to maximize their potential productivity and minimize the chances of excess moving offsite. One member asked for more research on nitrogen-fixation in non-leguminous crops.

Experts argued that more research is needed to reduce greenhouse gas emissions from agricultural production, particularly nitrous oxide from rice paddies, methane from ruminant livestock and both from manure and nitrogen fertilizer. Others argued for research to more accurately quantify the effects on the soil and on the productivity and profitability of various farming systems, e.g. various crop rotations, organic farming, and ‘regenerative’ practices. Several members called for the NIH to devote more of its research budget to human nutrition. One member called for research on the potential viability of a global agricultural reinsurance market to backstop national crop insurance systems

Several members observed that Federal support for extension has dropped even more than for agricultural research. They noted that more of the technology transfer function of the county extension agent was taken over by the local salesman for agricultural input

companies. They reminded the group that rural youth involved in 4-H had been a valuable vehicle for technology transfer and that home economics extension and 4-H had both been important vehicles for nutrition education.

Several members observed that agricultural research is severely under-resourced relative to the magnitude of the challenges of global food security in a world of climate change. Several members reminded participants that the 2023 farm bill is already in process and that more attention needs to be paid to global food security in the research title. Some suggested repurposing resources in that direction. Experts called for reauthorizing the Foundation for Food and Agriculture Research in the farm bill and for doubling the appropriations for agricultural research competitive grants and the USAID allocation to the CGIAR system of international agricultural research institutions. One member suggested there is a need for an “AgARPA.” Experts emphasized that continuous support for research is essential. One member reminded the group that when the NIH sought a doubling of its appropriation, Congress made and kept a commitment to increase its appropriation five percent per year until it had been doubled.

Both members and experts acknowledged that in the current budgetary environment it is going to be difficult to obtain additional funding for agricultural research. Some suggested that the best “hook” is likely to be “climate friendly agriculture” under the rubric of climate change.

A number of members emphasized that the research community needs to do a much better job of telling its success stories and how the public benefits. One member cautioned that U.S. agricultural interests are sensitive to the perception that research done in the U.S. when applied abroad may create competition for U.S. farmers. In reality, one expert explained there are greater spillover benefits back to American farmers from investing in international agriculture research. [Your edits changed the meaning of the 2nd sentence in this paragraph.]

Finally, members noted that the United States has many of the world’s best agricultural research and educational institutions, and it is not using its maximum potential to train scientists from developing countries to contribute to their agricultural development. The U.S. Government used to provide support in American universities for many graduate students from low-income countries across the agricultural and natural resources sciences.

Investments in Rural Development

Experts reminded attendees that the majority of the extreme poor in the world reside in rural areas, and the bulk of them are farmers. The inequality gap between urban and rural earning potential and opportunity is large and widening in most low-income countries. Educational and health care services are distinctly inferior in rural areas. Rural to urban migration in search of greater opportunity is rapid, but many migrants have few employable skills. Large numbers of unemployed young men often lead to gang activity and urban crime, which can become a political powder keg leading to political unrest and driving further international migration. Members noted that this is occurring in Central America.

Significant numbers of rural poor attempt to migrate to the United States and the high-income countries of Western Europe. Both members and experts observed that undocumented migrants generally would have preferred to stay in their home areas if they have opportunities for a better future there. Most leave their home countries to escape poverty and send substantial remittances back to their families. This highlighted the importance of reducing rural poverty in low-income countries for slowing the outmigration from such areas and illegal immigration into the United States and Western Europe.

Experts pointed out that the first way to reduce poverty in farm households is to increase the productivity of their existing farms. Farmers need access and ability to access (e.g. credit) improved varieties, organic and inorganic fertilizers, more effective means of controlling weeds and insects, and, in some places, irrigation. Climate change means that many farmers will have to adapt their practices just to sustain present productivity levels.

Poor farm to market roads result in higher cost of transport that makes production inputs more expensive by the time they get to the farmer. The prices received by farmers for their products are reduced by higher transport costs to urban markets. The miserable state of rural roads in many low-income countries is a huge barrier to adoption of better agricultural technologies which could raise farm productivity and household earnings. Experts indicated that the second way to reduce farm household poverty is to redeploy some of their land and labor to higher value crops like fruits and vegetables and livestock or poultry. Producing nutrient dense products has the potential additional benefit of improving the farm household's nutrition. Experts explained that this option is limited by the poor transport infrastructure in rural parts of many low-income countries. In addition, since producing each crop and livestock species has its own uniquenesses, some farmer training may be required to change their production. Experts pointed out that the cell phone revolution has reached deep into rural areas of

most low-income countries and opened up great opportunities in providing farmer education, market information, and banking services that were not previously available there.

Most higher value farm products are more perishable than staples, so refrigerated storage and transport are essential to make their production and marketing viable options. Experts noted that refrigerated storage and food processing to transform raw produce into forms which are less perishable require reliable electric power, which is often absent in rural parts of low-income countries.

Every country which has successfully reduced rural poverty has created non-farm employment opportunities within commuting distance so that most small farm households can supplement what they earn in farming from one or more non-farm sources of income. Experts observed that governments need to provide a positive investment climate, including commercial code and minimal corruption, to attract investors to make the investments that create the jobs necessary to ultimately solve the poverty problem.

In this regard, members observed that the U.S. International Development Finance Corporation (DFC) should be an important contributor to encouraging private sector investments in low-income countries by providing local currency guarantees, however it is much less effective than it could be because of the way the Congressional Budget Office scores its guarantees.

Investments in the food processing and value chain can have a particularly positive impact on rural economic development by adding value to the raw products of the land and creating non-farm jobs. Experts noted that definition and security of property rights, particularly land titling, is also essential for successful agricultural development.

Non-farm job creation is an essential component of successful long-term poverty reduction, experts noted. It is particularly urgent in regions where virtually all arable land is already in crop production and the average farm holding has less than two acres of land, as is the case in East and South Asia. Failure of a significant fraction of the youth growing up in rural poverty there to successfully leave farming and gain non-farm employment will lead to a downward spiral of increasing poverty as the small land holdings get carved up into even less viable sized farms in succeeding generations.

Experts noted that low-income country governments have an essential role in providing rural public goods including roads, schools, health services, agricultural research, and farmer training. With a positive investment in climate, the private sector should take care of the investment in railroads and electric power generation, just as it has in cell

phone services. In less densely populated regions, like Sub-Saharan Africa, governments may need to provide additional incentives for delivering electric power to remote rural areas. Experts and members pointed out the potential of various forms of renewable energy to satisfy this essential and growing need.

Experts suggested that the United States should be challenging African governments to increase their budgetary commitments to agricultural and rural development. In 2003, African heads of state committed to spend 10 percent of their government budgets on agricultural development in the Maputo Declaration on Agriculture and Food Security. Few have ever achieved that, with most governments spending somewhere in the low single digits.

Both members and experts expressed concern about the Great Power rivalry emerging in Sub-Saharan Africa and its implications for U.S. national security. This is the region of the world with the largest fraction of its population in extreme poverty and hunger, and its population is projected to almost double by the middle of this century. With rapid urbanization and economic growth in some countries, demand for food is exploding, yet agricultural production is a fraction of its potential, and climate change is hitting agriculture hard in this region.

China is investing twice as much foreign aid in Sub-Saharan Africa as the United States, particularly in roads. China is also now building agricultural experiment stations in the region. Russia has an active social media campaign of misinformation against the United States, and many countries in the region buy almost all of their fertilizer needs from Russia. Russia's Wagner Group is active in the Sahel, as is ISIS. The large number of frustrated, unemployed young men are ripe for recruitment by extremist elements. Some experts registered concern about the deeply indebted state of many countries in the region and the double whammy they have been hit with by high global agricultural commodity prices and the weakening of their currency exchange rates.

Experts argued that the United States has a national security interest in seeing Sub-Saharan Africa achieve its economic potential. They argued that, with its great convening power, the United States should be exercising much more leadership in this regard. One argued that instead of the United States hosting a U.S.-Africa Leadership Summit once a decade, it should be doing it at least every second or third year. China is hosting one every other year and is significantly outflanking the U.S. diplomatically in the region. As one member put it, "China is eating our lunch in Sub-Saharan Africa."

SCHOLARS' ESSAYS

The Global Food Crisis Shouldn't Have Come As a Surprise

(This essay was originally published by the [Foreign Affairs](#) on July 25, 2022)

Christopher Barrett

Stephen B. & Janice G. Ashley Professor, Dyson School of Applied Economics and Management, and Professor, Brooks School of Public Policy, Cornell University

The world's agricultural and food systems face a perfect storm. Overlapping crises, including the ongoing COVID-19 pandemic, wars in Ukraine and elsewhere, supply chain bottlenecks for both inputs like fertilizer and outputs like wheat, and natural disasters induced by climate change have together caused what the United Nations has called "the greatest cost-of-living crisis in a generation." World leaders cannot afford to ignore this unfolding catastrophe: rapidly increasing food prices not only cause widespread human suffering but also threaten to destabilize the political and social order. Already, along with skyrocketing energy costs, surging food prices have helped bring about the collapse of the Sri Lankan government.

But storms are increasingly predictable, and severe damage from them is therefore increasingly preventable. This is true of the current food crisis as well as extreme weather events. Political and business leaders have for too long ignored key fissures such as insufficient safety net coverage and lags in agricultural and policy innovations that leave agri-food systems—and the billions of people whose lives or livelihoods depend on them—vulnerable to the effects of other calamities. If the global response to the current food emergency likewise neglects these critical points, it may inadvertently exacerbate underlying problems, worsen and prolong unnecessary human suffering, and accelerate the arrival of the next perfect storm. Conversely, serious efforts to address not only the current crisis but also the long-standing issues that have helped cause it could move the world toward healthier, more equitable, resilient, and sustainable agri-food systems. World leaders and international organizations have a chance to make food emergencies and widespread acute hunger problems of the past; they must not let this crisis go to waste.

A Crippling Food Insecurity Crisis

The clearest evidence that the world is in the throes of a food emergency is the spike in food prices: the Food and Agriculture Organization of the United Nations estimated that global food prices were 23 percent higher in May 2022 than they were a year earlier. Moreover, they are now more than 12 percent higher than at the peak of the 2008–12 global food price crisis, a disaster that cast tens of millions of people back into poverty and sparked political unrest in dozens of countries. Indeed, the social and political upheaval across the Middle East that led to the 2010–11 Arab uprisings was partly driven by the high cost of food.

Dramatic increases in food prices pose severe health risks, including acute malnutrition or even famine, particularly in the developing world. According to the World Food Program (WFP), a record number of up to 323 million people are now, or are at risk of soon becoming, acutely food insecure (the technical term for nutrient intake deficiencies that puts a person's life or livelihood in immediate danger). In more than a dozen desperately poor countries—Afghanistan, Angola, Burkina Faso, the Central African Republic, the Democratic Republic of the Congo, Ethiopia, Haiti, Kenya, Niger, Somalia, South Sudan, Sudan, Yemen, and Zimbabwe—hundreds of millions of people already face severe food insecurity. In the absence of adequate, appropriate, rapid humanitarian response, many people will die unnecessarily.

There is more than enough food in the global system to go around. Even amid the current crisis, global daily food supplies average roughly 3,000 calories, 85 grams of protein, and 90 grams of fat per person, far exceeding human metabolic needs for a healthy life. The core drivers of hunger and malnutrition are poverty and maldistribution, including excessive food loss and waste, not insufficient agricultural production. Today, roughly three billion people are too poor to afford a healthy diet and perhaps a billion more could soon suffer similarly. Higher food prices disproportionately hurt the poor for the simple reason that they spend a far larger share of their income on food. Without adequate safety nets, preferably ones that are triggered automatically for people with incomes below a certain threshold or when food prices rise too high, people suffer unnecessarily.

History and the current crisis sadly show that Western politicians' discretionary responses routinely prove insufficient and may even aggravate existing inequities. In Ukraine, for instance, the global humanitarian response has been laudably swift. As a result, it is not among the countries facing food emergencies, despite the fact that Russia's invasion has driven more than 12 million Ukrainians from their homes. Nor are high food prices causing mass hunger among displaced Ukrainians. Yet in Yemen, which has suffered a terrible civil war for eight years, the WFP estimates that a record 19

million people are food insecure. If the international community were equally generous where brown-skinned peoples similarly face war and acute food insecurity, the global food system would have adequate supplies to address the problem.

Build Better Safety Nets

If the international community is serious about addressing the food crisis—and about fixing a global agri-food system that leaves vulnerable and marginalized communities unevenly exposed to hunger and famine—it must build better safety nets. Food price spikes only cause mass malnutrition when safety nets are inadequate. The world has ample food supplies to feed everyone a healthy diet, even in the face of natural and manmade disasters. But it lacks mechanisms to trigger responses that equally protect people in locations less geopolitically important than Ukraine, or among populations of the so-called global South that may be less visible to leading Western governments. Establishing automatic global safety nets, through a combination of financial arrangements contractually triggered by disasters and treaty commitments among governments, could build effective safeguards that are increasingly needed with climate change.

The G-7 countries just pledged an additional \$4.5 billion for emergency global food assistance, which sounds generous. Unfortunately, that brings global commitments up to only \$14 billion, less than one-third of the \$46 billion in current total humanitarian appeals worldwide. And international aid is down amid the pandemic. The massive costs that governments have shouldered to fund domestic COVID-19 responses have understandably limited humanitarian spending abroad. But penny pinching by the world's richest countries risks precipitating crises in the coming years that could be far greater, in both monetary cost and human suffering, than the current crisis.

Policymakers must also work to address humanitarian emergencies promptly and fully, or risk downstream crises that could be far more serious. Ignoring food emergencies doesn't make them go away nor cheaper to address later. In fact, it often leads to more challenging problems that are more difficult to tackle, mostly because higher food prices and greater acute food insecurity are strongly associated with forced migration. When people grow desperate to feed their families, they take risks, most commonly by fleeing their homes. Any humanitarian agency can attest that it's far more expensive to meet the needs of displaced people than it is to help people in their own homes before circumstances compel them to leave. And the number of displaced people is growing. At the end of 2021, a record 89 million people had already been forcibly displaced, even before Russia's invasion drove 12 million Ukrainians to flee their homes.

Moreover, the failure to address humanitarian needs incurs there steep sociopolitical costs, both for countries that need assistance and for those that might provide it. High food prices lead to an increased risk of conflict and political unrest in countries with weak social safety nets. Roughly four dozen countries experienced domestic political unrest or civil war during the 2008–12 global food price crisis. Governments in Haiti, Libya, Madagascar, and Tunisia fell, sometimes violently, and protracted civil wars erupted in Syria and Yemen.

Those problems can also spill over into high-income countries. Europe’s migrant crisis began in 2011 with mass unrest across North Africa and West Asia over spikes in food prices; it culminated in 2015 when waves of Afghanis, Iraqis, Syrians, and others fleeing civil war sought refuge in Europe. The nationalist, anti-immigrant domestic political response that predictably followed heralded a distinct rightward shift in European—as well as U.S.—politics over the last decade. Russian President Vladimir Putin may be looking to replicate Europe’s migrant crisis by aggravating the preexisting global food crisis.

Indeed, Russia’s invasion of Ukraine didn’t cause the food price crisis so much as it aggravated an already existing problem. Global food prices were already rising quickly before the war. Although food prices fell during the very beginning of the pandemic, they rose rapidly through last year—in October 2021, they blew past the December 2010 prior global food price record. Russia’s invasion of Ukraine and blockade of its Black Sea ports certainly accelerated this trend by disrupting wheat, sunflower oil, maize, and fertilizer exports, driving global food prices up 18 percent just from January to March 2022. Nonetheless, global food prices peaked a month into the invasion and have since tapered off slightly in response to reasonably favorable growing conditions in other major producing countries, the rising risk of recession in major economies, and an agreement to open a Black Sea corridor to evacuate Ukrainian export commodities. This is because the supply shock arising from the Ukraine war is relatively small. Of the roughly three billion tons of grain produced globally each year, the loss of perhaps half of Ukraine’s exports—which is likely the upper bound—implies a supply shock of less than one percent. That’s less than what was lost to the severe 2012 drought in the United States’ Midwest—not enough to cause a crisis.

Time for New Trade Agreements

As they craft a response to the current food emergency, policymakers should also assess the need for a global agreement to tie governments’ hands when domestic political forces agitate for export bans. Russia’s invasion of Ukraine was not the only cause of the February–March rise in food prices. Ill-advised export bans by a few major food-producing countries looking to insulate domestic consumers from rising global

market prices also contributed to this spike in costs. India banned wheat exports, Indonesia blocked palm oil exports, and China prohibited the export of agrichemicals. Repeating errors made during the 2008–12 global food price crisis, several governments caved to domestic political pressures and imposed export bans in the hope that they could prevent global price shocks from affecting domestic markets. Such policies inevitably quickly fail. Meanwhile, bans temporarily fuel faster and greater—if short-lived—price increases among importers that must scramble to find new suppliers to fill interrupted supply chains, temporarily jacking up prices in the process.

Only about one-quarter of the food consumed globally depends on international trade. Trade doesn't feed the global population so much as it stabilizes prices, dispersing varied demand and supply shocks across the world quite effectively. No nation can be reliably self-sufficient and adequately nourished. The world needs orderly trade regimes to absorb the shocks that inevitably occur, especially as climate change progresses. The World Trade Organization (WTO) was created during a period of steadily falling real food prices; they hit an all-time low in December 1999. Because its rules were negotiated during an era of falling prices, the WTO has effective tools to limit governments' ability to indulge domestic political pressure for protectionism around imports that lead to lower prices. But when prices rise, the protectionist impulse concerns exports, not imports, and the WTO lacks corresponding agreements to constrain governments' ability to restrict exports. New trade agreements to rectify this oversight are needed if the world is to get a handle on food prices.

Reimagining the Agri-Food System

Policymakers must also recognize the urgent need to promote innovation in agri-food systems. Through greater investment in research and development and more creative policies, it would be possible not only to boost agricultural productivity but also to reduce food loss and waste, and the demand for agricultural commodities as livestock feed and transport fuel, rather than food. An enormous structural problem in the agri-food system is that demand for grains and oilseeds for biofuels, and especially for animal feed, has grown far faster than the demand for food.

Public agricultural research and development has a very high return on investment. Yet U.S. public investment in agricultural research has fallen by one-third over the past two decades, and ongoing investments remain heavily concentrated in refining traditional crops and methods. Part of the problem is that governments and policymakers often look for short-term results, whereas the most effective agri-food innovations pay off handsomely over years and decades. Among long-term innovations, governments should be investing in circular systems that can recycle waste products into fertilizers and feed; controlled environment agriculture that can reduce land, pesticide, and water

use and crop loss to pests and pathogens; and alternative proteins that can produce healthy, tasty products at a fraction of the agrichemical, land, and water costs of current systems. They must also push for the institutional and policy innovations that can encourage private investment in these new technologies.

Private investment in agri-food systems is far larger than state investments but only slightly better, tending to concentrate on luxury goods and services rather than on projects that could address high food prices and mass acute food insecurity. Although rising food prices in 2021 boosted venture capital agri-food tech funding up to \$52 billion, an 85 percent increase over 2020, the largest single category was online grocery shopping. Although it is an understandable response to COVID-19 lockdowns, fancy delivery apps do little to nothing to reduce food insecurity, greenhouse gas emissions, biodiversity loss, or water stress, and they may aggravate the global obesity epidemic.

The estimated \$26 billion it would cost to eliminate global hunger represents less than one percent of the \$2.7 trillion in cash on hand in early 2022 among the 500 companies listed on the S&P index. If governments built policy and institutional innovations to attract even a modest fraction of that money to tackle the underlying imbalances that leave the world vulnerable to perfect storms like the one it faces now, that would be a game-changer for accelerating agri-food systems transformation. Real leadership—from the private, philanthropic, and public sectors—will manifest in championing smart and substantial investment in agri-food systems transformation.

Like extreme weather events, perfect storms that cause mass acute food insecurity are happening more and more often. It took 35 years for the world to experience another food crisis after 1973–74, but less than a decade after the 2008–12 disaster for the current emergency to hit. Policymakers, international organizations, and the private sector must develop an appropriate, timely, and sufficient humanitarian response regime—not only to avoid unnecessary human suffering now but also to address the larger-scale, longer-term challenges that leave the world increasingly vulnerable to food crises precipitated by a wide range of shocks. These key points—safety nets, immediate action, limits on export bans, better research and development, and thoughtful investment—must guide public and private policy. Policymakers must address the immediate global food emergency with prompt and generous humanitarian aid and orderly international trade. They must also marshal the major research and development investment and policy and institutional innovations necessary to bend the arc of agri-food systems away from increasingly frequent and calamitous crises and toward a healthier, more equitable, resilient, and sustainable world.

Strategies to Ensure Global Food Security: U.S. Policies to Sustain Supply, Relief and Advance Prosperity

Tjada D'Oyen McKenna

CEO, Mercy Corps

The evidence is clear that COVID-19, the climate crisis, and most recently the war in Ukraine are erasing the gains made in reducing malnutrition globally. The cost of the current global nutrition crisis is exponentially higher because of insufficient sustained investments in addressing the social, political, and economic causes of hunger and malnutrition. An estimated 45 countries need external assistance for hunger relief due to conflict, extreme weather events and soaring inflation. Communities facing acute food insecurity, humanitarian emergency, or famine like conditions, are often clustered in fragile or active conflict environments. Households in these communities have not recovered their livelihoods' loss from the COVID-19 pandemic, only to have already been hit with additional shocks, from drought in the Horn of Africa to flooding in northeast Nigeria to skyrocketing food prices in Lebanon. The World Food Programme estimates that by 2050, climate change could increase the risk of food insecurity up to 20%.

After steady declines in food insecurity globally for over a decade, that trend has now reversed. Nearly eight percent of the world population - 670 million people - will face hunger in 2030, representing no improvement since the Sustainable Development Goals were adopted in 2015. According to the World Health Organisation, more than 30 million children in the 15 worst-affected countries currently suffer from wasting – or acute malnutrition – and eight million of these children are severely wasted, the deadliest form of undernutrition. UNICEF estimates that this year's global food crisis will push an additional 260,000 children into severe wasting.³ Even countries that are not in the global spotlight of the current crisis are witnessing nutrition backsliding, for example Uganda, which has seen a 61% rise in wasting since 2019.⁴ Food shortages, income loss, and purchasing power in 2023 are likely to be even more acute as the climate crisis and conflict continue decimating crop yields from Somalia to Nigeria to Pakistan, and the longer-term impacts of increased prices and fertilizer shortages begin to emerge.

³<https://www.unicef.org/press-releases/global-hunger-crisis-pushing-one-child-severe-malnutrition-every-minute-15-crisis>

⁴ <https://www.unicef.org/media/121891/file/English.pdf>

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The crisis in Ukraine has only exacerbated an already dire situation. Our global food systems were already failing and record numbers of people were edging toward poverty and hunger due to COVID-19 and the impacts of conflict and climate change. Ongoing attempts to secure access to Ukraine's grain exports have faced political and logistical challenges, threatening to further constrain global food supplies.⁵

The dangerous consequences of undernutrition disproportionately impact women and children. A recent UNICEF report shows that more than one billion adolescent girls and women suffer from undernutrition, deficiencies in essential micronutrients and anemia, with devastating consequences for their lives and wellbeing and impacts lasting for generations.⁶ The low diversity of adolescent girls' and women's diets can be found across several environments, but is pronounced in fragile countries. Malnutrition leaves individuals, especially children, vulnerable to disease, and developmental delays. Maternal undernutrition creates higher risks for childbirth complications, fetal development, and long-term impacts on growth, learning, and the economic capacity they underpin. UNICEF reports that among infants and children six to 23 months, about half are not fed the minimum recommended number of meals and are missing the benefits of the most nutrient-rich foods. The global food crisis is deepening the nutrition crisis, particularly for adolescent girls and women, which will lead to long term impacts if not addressed⁷

Lessons Learned (and Those Not)

Sadly, this is not the first food crisis in a lifetime, or even in the past 20 years. The food price crisis of 2007-2008 saw a surge of more than 40 million additional people experiencing hunger according to the Food and Agriculture Organization (FAO), with the cost of staple commodities such as maize and wheat spiking.⁸ In 2012, famine was belatedly declared in Somalia, at which point an estimated 285,000 people perished, with many families watching their children starve to death.⁹ In 2016, the United States blunted the effects of a looming food crisis by providing nearly \$1 billion before conditions worsened, demonstrating the effectiveness of early action. However, these lessons have not been consistently applied, including in the response to the current drought in the Horn of Africa, which has been delayed and insufficient.

⁵ <https://www.mercycorps.org/press-release/ukraine-grain-deal-access>

⁶ UNICEF, *Undernourished and Overlooked*, March 2023
<https://data.unicef.org/resources/undernourished-and-overlooked/>

⁷ UNICEF, *Undernourished and Overlooked*, March 2023
<https://data.unicef.org/resources/undernourished-and-overlooked/>

⁸ https://unctad.org/system/files/official-document/gdsmdp2420093_en.pdf

⁹ https://fic.tufts.edu/wp-content/uploads/somalia_case_study_jan_6_2016.pdf

What these food crises have in common is that they keep happening with increased frequency. In communities where Mercy Corps works, a girl born in the midst of the 2007 food crisis is likely to have at least one child by the end of this year. The challenges she endured then are likely repeating themselves in the life of her child. The question that should be asked is how have we sought to improve her and her child's access to nutritious food, her ability to provide for herself and her family, and weather future shocks and stresses that would otherwise threaten their nutritional health.

The U.S. has made strides in this space. Feed the Future, the US government's flagship global food security program, recognizes the importance of a whole-of-government effort to end hunger by tackling its root causes, not just its symptoms.¹⁰ Feed the Future acknowledges nutrition as an integral part of the initiative's design, working to draw on learning and stop the cycle of irreversible harm from malnutrition. Subsequent efforts, including the bipartisan passage of the Global Malnutrition Prevention and Treatment Act by Congress in 2022, have further sought to improve global nutrition outcomes through U.S. foreign assistance. Coordination across the U.S. government has also improved, with stakeholders such as the U.S. Agency for International Development, the U.S. Department of Agriculture, the Centers for Disease Control and Prevention, and others taking strategic steps to improve nutrition outcomes collectively, though much more should be done.

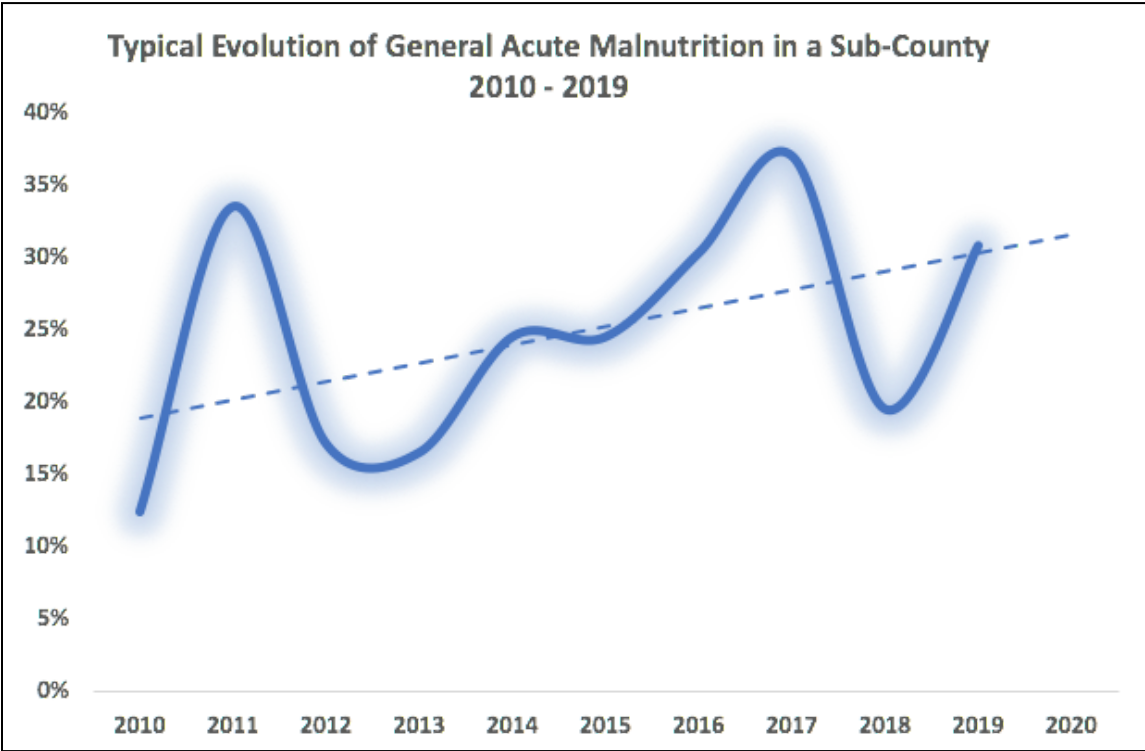
However, unlike other foreign assistance efforts, such as the President's Emergency Plan for AIDS Relief (PEPFAR) or the Trafficking Victims Protection Act, the lack of coordination between humanitarian and development investments is hindering progress. In the face of acute crises, immediate, lifesaving food and nutrition assistance is often scaled up without ensuring that it supports and syncs with longer term nutrition and food security programs. The paradigm of "save lives first, and then turn to development" must be shifted to one that embraces layered and coordinated efforts to do both simultaneously if we are going to break the cycle of hunger and malnutrition.

Emergency programs are lifesaving and necessary. Ready to Use Therapeutic Food and Ready to Use Supplemental Food (RUTF and RUSF, respectively) have been game changers in combating malnutrition, bringing children back from the brink of starvations. These specialized nutritious foods, in combination with routine medication such as antibiotics, save millions of lives every year and help prevent long-term physical and developmental harm. However, globally it is estimated that only one third of children suffering from wasting receive the necessary treatment for malnutrition. Though there are various reasons for this, one of the biggest bottlenecks to scaled response is irregular and insufficient availability of supplies. This is especially the case for routine medicines and commodities for treatment of Moderate Acute Malnutrition

¹⁰ <https://www.usaid.gov/global-health/health-areas/nutrition/usgplan>
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such as Super Cereal Plus and RUSF. In addition, the recent war in Ukraine has led to a price spike in one of RUTF's main ingredients, vegetable oil, confounding the supply chain. While such disruptions have been a regular feature of nutrition programming, the combination of soaring demand, increased global costs of raw materials and shipping, and slow lead times, has hampered the ability of health workers to provide quality services to treat acute malnutrition this year.

However, the question remains: how did we end up with so many at the brink of acute malnutrition? It is clear that responding only with humanitarian assistance is neither sufficient nor sustainable. The provision of humanitarian assistance is a temporary salvation, and one that can, in certain cases, weaken the local food systems. The graph below demonstrates the impacts on nutritional status of a community in Kenya when humanitarian assistance was introduced without investing in the local food system for sustained access to nutritious foods. The initial peaks represent the high levels of malnutrition reached when there was delayed early action using the early warning information to respond to increasing food insecurity. The steady decline represents pure humanitarian assistance delivered. The resurgence of malnutrition after 2012 was because other tools to tackle underlying causes of chronic causes of malnutrition and investing in nutritious food systems and coordination between actors were not prioritized and layered during the initial humanitarian response. Meeting immediate needs through humanitarian assistance is crucial, but must be done in parallel to efforts that strengthen the resilience of local food systems to prepare for shocks.



Protracted crises, both conflict- and climate-driven, require durable political solutions. No amount of humanitarian assistance will resolve these challenges. Further, the number of fragile contexts, where communities are constantly on the brink of crisis and which are particularly vulnerable to shocks and stresses, is rising. The U.S. has committed to looking further upstream to head off these potential flashpoints with bolder prevention efforts, including through policies and approaches enshrined in the Global Fragility Act. Addressing fragility that leads to conflict—one of the primary drivers of food insecurity—is a critical pillar of preventing malnutrition and should be seen as part of a whole-of-government approach.

The Value of Investing in Local Food Systems for Improved Nutrition

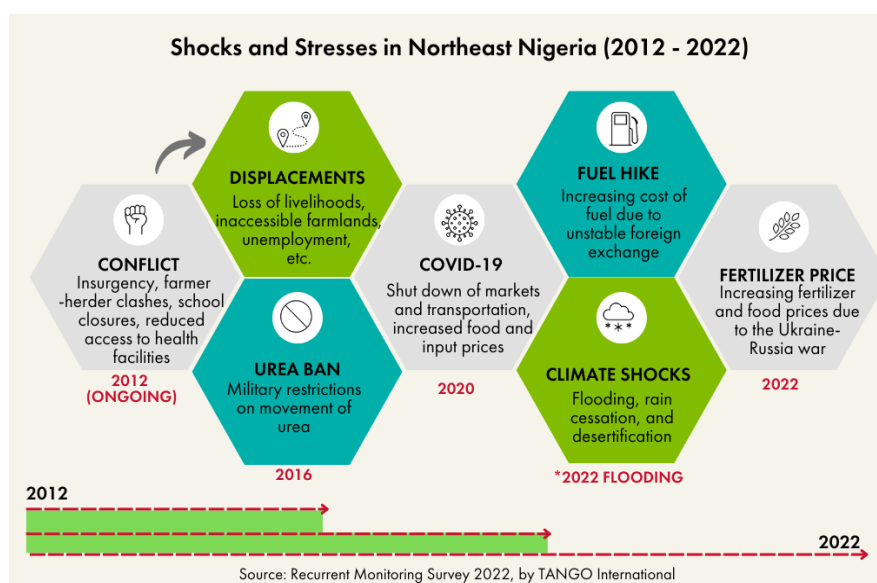
Beyond meeting immediate needs, strengthening food systems that are the foundation of nutrition for individuals, families, and communities must be a core focus of US foreign assistance. It is important to remember that many food insecure households are net consumers, rather than net producers of food. The Board for International Food and Agricultural Development (BIFAD) notes that “inefficiencies in agricultural-product value chains inflate the cost of highly perishable, nutrient-dense foods, particularly among rural communities where populations are widely dispersed.”

Strengthening local food systems, especially in conflict settings, is essential not only for improving food security outcomes in the midst of conflict, but also for laying the foundation for long-term recovery and well-being. The increasing use of cash-based assistance is important for efficiently supporting basic needs in ways that work through local markets. However, it is also necessary to take intentional and specific steps to support markets beyond cash-based assistance as they are the backbone of communities, providing economic incomes, access to critical inputs and a critical foundation to surviving and recovering from shocks.

Investments in local food systems are critical for making food more affordable for vulnerable communities. Cash transfers to support consumption, bolstered by interventions that increase the capacity and resilience of local businesses and trade networks—particularly those for nutritious foods—are critical to ensuring reliable food access. All too often, interventions do not take into account these critical, reinforcing investments, focusing instead on the more traditional forms of humanitarian response. While critical to saving lives in the immediate terms, this singular approach fails to strengthen market systems which is key to increasing community resilience to current and future shocks.

When the COVID-19 pandemic hit, Mercy Corps disbursed cash to more than 50,000 recipients to ensure livelihoods and local food systems did not collapse—a decision that

was based on learning from successful approaches to previous shocks. Unlike a typical humanitarian cash distribution in which the primary goal is to help the most vulnerable individuals survive, these cash transfers had the dual aim of helping vulnerable households meet their basic needs *and* begin reinvesting in economic activities. As a result, transfers were given to farmers, local business owners, processors, and food processors throughout the food system, 56% of whom were women. This was done through the use of a crisis modifier, a mechanism built into USAID development programs that can be triggered to provide supplemental support in the case of an unexpected shock. The cash was used by the recipients to buy food and invest in agricultural systems, blunting the immediate effects of COVID-19 and supporting long-term economic resilience.



Gender As Barrier and Opportunity

According to UNICEF, the gender gap in food insecurity more than doubled between 2019 (49 million) and 2021 (126 million), with girls and women across the world disproportionately hit by the impact of the COVID-19 pandemic on livelihoods, income, access to nutritious food, and negative coping strategies like child marriage.¹¹ This corresponds to the experience of many other crises in which women and girls bear the brunt of the impacts felt by vulnerable communities.

By the same turn, evidence has consistently demonstrated that targeting women and female-headed households in an inclusive, culturally-sensitive way, magnifies the positive effects of an intervention on the entire community. In Nepal, Mercy Corps has

¹¹ <https://data.unicef.org/resources/undernourished-and-overlooked/>

supported the formation of female producer groups which when combined with financial literacy and agricultural training, is allowing them to take advantage of a new market opportunity by selling fruit and vegetables to schools for school feeding programs. Nutrition education for households, particularly when combined with social protection to combat harmful social norms that affect women and girls' access to food, improves both individual and community nutritional outcomes.¹²

Progress Is Not a Straight Line

The past 20 years have demonstrated that there is no linear path from emergency humanitarian response to long-term, sustainable development gains. At the same time, we have built up our knowledge of what it takes to get life-saving nutrition support and services to those communities, particularly women and children, who need it most. But time and time again, these lessons do not shape our actions and the foreign assistance community fails to combine and target interventions to ensure that they not only save lives, but build foundations towards greater shock resistance and resilience.

Alongside the much-needed urgent emergency action to save lives, we also need to find long-term solutions to ensure availability, affordability and accessibility of healthy diets for all - including through tackling the root causes of acute malnutrition. Donors should fully fund humanitarian response plans as well as commit long term and flexible financing for food security and nutrition. In the immediate term, Mercy Corps is advocating for greater flexibility from donors to directly purchase needed nutrition supplies from licensed manufacturers, rather than being entirely reliant on the United Nations system for them. The goal is for governments to purchase their own nutrition supplies, and ultimately be able to prevent and detect malnutrition earlier by strengthening national health and nutrition services in countries where they are needed

More broadly, there is a critical need for a longer-term vision and increased accountability for improving global nutrition, integrated across food, health and social protection systems and supporting communities for sustainable development. Donors should fund interventions that layer humanitarian response with local food systems investments to help communities protect hard-won gains, cope with current food insecurity and malnutrition and prepare for inevitable future crises.

In northeast Nigeria, Mercy Corps is layering multiple approaches to improve nutrition while addressing the drivers of malnutrition, including economic insecurity. Mercy Corps' approach has deliberately linked our humanitarian nutrition portfolio with our longer term food security programming. While our humanitarian assistance aims to

¹² <https://www.thelancet.com/series/maternal-child-undernutrition-progress>
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respond to immediate basic needs by preventing, identifying, and treating malnutrition, food security programs such as Feed the Future simultaneously seek to increase year round availability and access to safe, diverse and nutritious foods by crafting viable linkages across the breadth of the market.

Deteriorating hunger and nutrition in communities will not be mitigated by emergency cash assistance to individuals and families alone; cash grants to small and micro business owners to shore up livelihoods, from agricultural input suppliers to traders, can prevent local food systems from collapsing and plunging communities further into protracted food insecurity and malnutrition.

At the household level, more support is needed to identify and treat malnutrition. Donors should encourage aid actors to complement cash transfer programming aiming to improve food security with basic nutrition programming to, at minimum, help identify and refer malnutrition cases. Research suggests that in crisis-contexts, cash transfers are more likely to drive positive nutrition outcomes when complemented by malnutrition screenings and nutrition education.¹³ Aid actors can empower families to identify cases of malnutrition, bolstering malnutrition referral processes, and supporting access to basic health services and products.

The New Normal

The global food crisis has evolved over this past year and will continue to unfold, exacting both short and longer term impacts around the world on those least able to cope. The U.S. has been a clear leader of the global response, driving greater political will among the international community to address it and providing record levels of humanitarian assistance to blunt its harshest effects. This political will and leadership will be required not only to respond to this current crisis, but in pivoting toward more holistic approaches to address the root causes of food insecurity and malnutrition, ones that will strengthen the food systems and vulnerable communities to withstand inevitable future shocks.

This is our “new normal” rather than a “one and done” natural disaster or temporary spike. It is a harsh reality to process, but it can be surmounted by embracing proven approaches to respond to emergencies while strengthening the food systems, livelihoods and access to nutritious foods that enable the most vulnerable to cope, adapt and thrive in the face of repeated crises.

¹³ For example, from Yemen:
<https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/133219/filename/133430.pdf>

Addressing Global Food Security

David Beasley

Former Executive Director, World Food Programme (WFP)

The world is in trouble. Leaders all over know that one of the most urgent tasks facing humanity is to stop the current food pricing crisis spiraling into a much more dangerous food availability crisis as 2023 progresses. The roots of the current global hunger emergency are complex and fed variously by conflict, climate change, the continuing economic ripple-effects of COVID-19 and now, most recently, by the war in Ukraine.

To put simply, the world is facing a humanitarian crisis of unprecedented magnitude, with the threat of mass starvation and famine growing all the time. Global grain, fuel and fertilizer shortages sparked by the Ukraine conflict have left many already-vulnerable families in middle and lower-income countries no longer able to cope after exhausting the meager resources they have at their disposal. The result is food insecurity, malnutrition and despair on an unimaginable scale.

What was a wave of hunger is now a tsunami of hunger. The World Food Programme's (WFP) latest analysis has found that, currently, 345 million people are acutely food insecure – in other words, they are marching towards starvation. This is a record high and more than 2.5 times the 135 million people who were living with acute food insecurity before the pandemic began.

Among this 345 million, there are some 43 million people living in 51 countries in even graver danger – they are just one step from famine. Most worrying of all, there are nearly 850,000 people living in what are essentially famine conditions – in Burkina Faso, Haiti, Mali, Nigeria, Somalia, South Sudan, and Yemen. Although the technical criteria have not yet been reached for famines to be declared, it may only be a matter of time before these thresholds are crossed in the months ahead.

The Black Sea Grain Initiative – the United Nations-brokered deal which is enabling some Ukrainian wheat and grain to reenter export markets – and ongoing efforts to reintegrate Russian-produced fertilizers into global supply chains are welcome, and they should continue at all costs. But by themselves they are not enough to reverse the soaring worldwide food, fuel and fertilizer prices seen over the past 12 months that threaten to slash the crop yields of smallholder farmers everywhere.

A coordinated response is required from the international community to address the worrying picture of falling food production and rising hunger unfolding across much of Africa, Asia, and the Americas. We have a choice to make: act now to save lives and invest in solutions that support food security, stability and peace; or see famines, increased social instability and strife, and mass migration grow and spread.

Humanitarian organizations such as WFP are mobilizing all available resources to get lifesaving help wherever it is needed most, scaling up direct food and nutrition assistance to prevent famine. Last year WFP reached 160 million people – the highest number in its 60-year history. But, tragically, the focus on staving off famine comes at a human cost. As humanitarian needs far outstrip the financial resources available, frontline aid workers are being forced to take food from the hungry to feed the starving.

All over the world, funding shortfalls for operations mean country teams are having to make the agonizing decision to cut food rations and cash assistance to some hungry families to prioritize those in grave danger. It is happening in Afghanistan, Chad, the Democratic Republic of the Congo, South Sudan, Syria, Yemen – the list goes on.

A coordinated effort across governments, international financial institutions, the private sector, and civil society is the only way to avoid an even more deadly global hunger crisis, driven by lower food production and shortages of basic foodstuffs. Against this backdrop, the leadership shown by the United States as they rally the commitment and resources required to avert mass starvation is inspirational, and essential. Other nations and actors must step up and contribute to save lives.

In the short term, this means adequately funding famine-prevention and humanitarian programs to ensure the most vulnerable communities receive the support needed to get through the storm. This should be coupled with investment in agricultural support programs so smallholder farmers can access essential inputs like fertilizers and seeds, shoring up food production during this volatile period.

In the longer term, it means investing in programs which foster sustainable economic development so vulnerable communities are more self-sufficient and better able to withstand future food security shocks.

The hungry people of the world are counting on us in this time of extraordinary need. We must not let them down. It is time for world leaders to come together and work in support of sustainable, resilient food systems that can feed every single person on our planet.

Rising Global Food Insecurity: Assessing the Current Situation

Máximo Torero Cullen

*Chief Economist,
Food and Agricultural Organization of the United Nations*

At the beginning of 2022 global food security was already in a state of deterioration as a result of the measures adopted to contain the COVID-19 pandemic, new or pre-existing conflicts, weather shocks and global economic slowdown. Up to 828 million people were hungry in 2021 (Figure 1, left panel). The number of people affected by chronic hunger had grown by about 150 million since the outbreak of the COVID-19 pandemic. After remaining relatively unchanged since 2015, the prevalence of undernourishment in the world jumped from 8.0 in 2019 to 9.3 percent in 2020 and rose at a slower pace in 2021 to 9.8 percent.[1]

Severe food insecurity [2] increased in every region of the world in 2021, including in high-income regions (Figure 1, right panel). Nearly 30 percent of the world population were moderately or severely food insecure in 2021 and 11.7 percent faced food insecurity at severe levels. The estimates also suggest that 3.1 billion people globally could not afford a healthy diet in 2020, an increase of 112 million more people than in 2019.[3] Projections suggest that nearly 670 million people globally, equating to 8 percent of the world population, would still be undernourished in 2030, placing the world off track to achieve the Sustainable Development Goal 2 of Zero Hunger. Moreover, the disparity between men's and women's food security is 8.4 times as great as it was in 2018 and will likely increase with the compounding effects of the global food security crisis.[4] The fact that severe food insecurity rose across all regions should prompt a reflection on national policy priorities, as well as on the global responses. Rising hunger has reverberations upon other dimensions of malnutrition, including micronutrients deficiency, and impacts peoples' ability to engage productively in the broader economy.

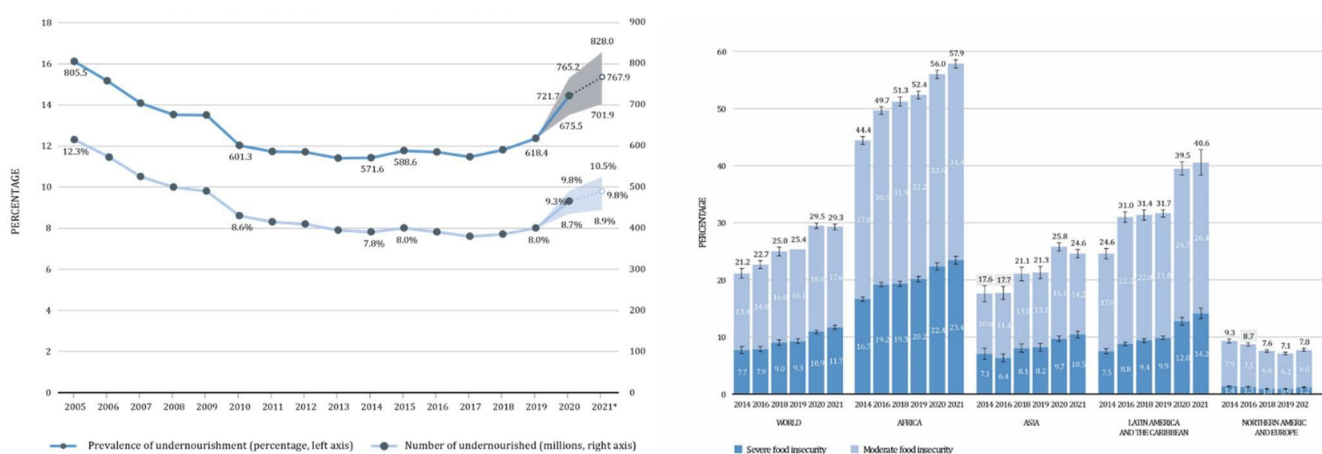
In 2022, chronic hunger is expected to remain at a high level, higher with respect to the pre-COVID era and around the levels observed in 2021. A combination of a slow recovery (higher income due to higher employment in 2022) offset by higher food prices might explain why hunger did not decrease in a significant manner in 2022.

Moderate or severe chronic food insecurity is also expected to be stalled with respect to 2021 but at a higher level with respect to 2019, the year before COVID-19. In Africa,

moderate food insecurity is expected to rise, compensated by a decrease in Latin America and in Asia.

At the same time, a confluence of factors led to increasing food prices in 2020 and 2021. As demand started to recover in mid-2020 from the dramatic decrease in economic activity at the beginning of the pandemic, agricultural commodity prices rebounded from a 10-year low in May 2020.

Figure 1: Global hunger has been on the rise since 2019 (left) and severe food insecurity increased in every region in the world in 2021 (right)

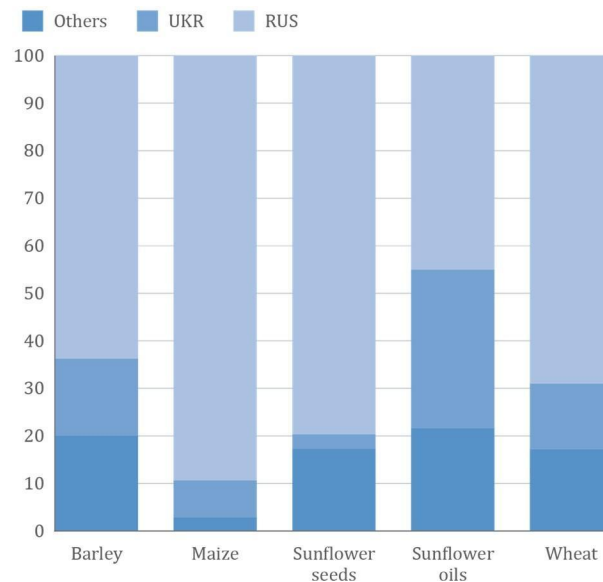


Source: FAO, IFAD, UNICEF, WFP & WHO. 2022.

Export restrictions contributed to increased price volatility and higher price levels in the early pandemic period.[7, 8] Fears of supply chain disruptions and production shortfalls because of pandemic-related restrictions led some countries to impose restrictions on exports of staple foods. However, compared to the 2007-08 global food price crisis, export restrictions affected a smaller share of world food trade as fewer countries had imposed restrictions and for shorter durations.[9]

Just as global economic conditions appeared to be recovering from the pandemic slowdown, the outbreak of the war in Ukraine in February 2022 sent another shock through global food and agricultural markets. The Russian Federation and Ukraine are among the most important producers and exporters of agricultural commodities in the world.[10, 11] In 2021, either the Russian Federation or Ukraine (or both) ranked among the top three global exporters of wheat, maize, rapeseed, sunflower seeds, and sunflower oil (Figure 2). In the same year, the Russian Federation also stood as a prominent exporter of fertilizers (see Section 6).[12]

Figure 2: Shares in global production of selected crops (2021, percent)



Source: FAO. 2022. The importance of Ukraine and the Russian Federation for global agricultural markets and the risks associated with the war in Ukraine.

Box 1: Levels of Food Insecurity

Chronic hunger: is defined as the long-term or persistent inability to meet minimum food consumption requirements and is measured by the Prevalence of Undernourishment (PoU).

Hunger: Hunger is an uncomfortable or painful physical sensation caused by insufficient consumption of dietary energy.

Prevalence of undernourishment (PoU): an estimate of the proportion of the population that lacks enough dietary energy for a healthy, active life. It is FAO's traditional indicator used to monitor hunger at the global and regional level, as well as SDG Indicator 2.1.1.

Severe food insecurity: is the level of severity of food insecurity at which people have likely run out of food, experienced hunger and, at the most extreme, have gone for days without eating, putting their health and well-being at grave risk, based on the Food Insecurity Experience Scale (FIES).

Moderate food insecurity: refers to the level of severity of food insecurity, based on the FIES, at which people face uncertainties about their ability to obtain food and have been forced to reduce, at times during the year, the quality and/or quantity of food they consume due to lack of money or other resources. It thus refers to a lack of consistent

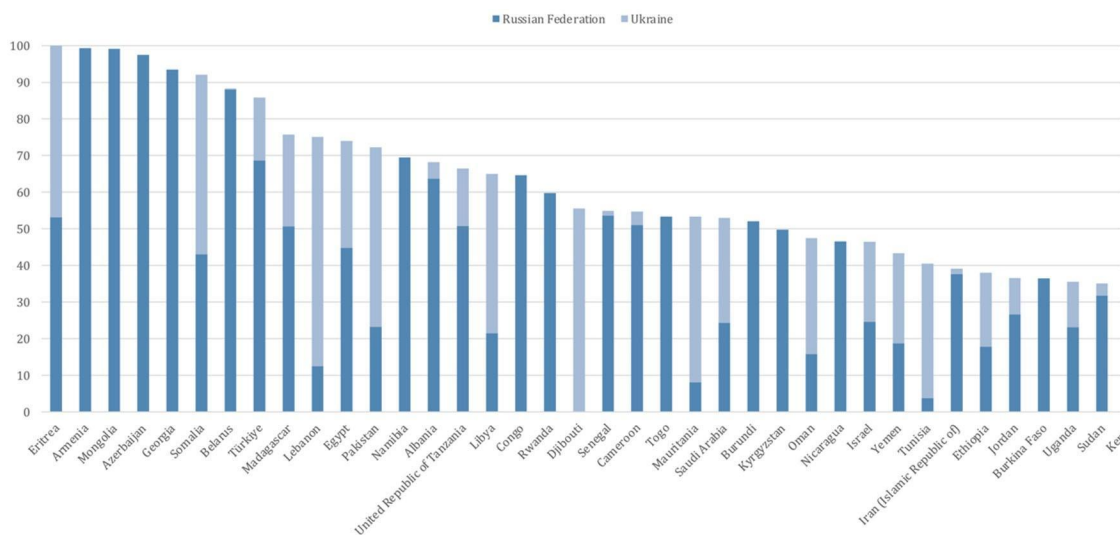
Ukraine and the Russian Federation are key suppliers to many countries that are highly dependent on imported foodstuffs and fertilizers.[13, 14] Wheat imports of many countries situated in North Africa and Western and Central Asia are highly concentrated

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towards supplies from the Russian Federation and Ukraine due to geographical proximity. Overall, more than 30 net importers of wheat have been dependent on both countries for over 30 percent of their wheat import needs (Figure 3). Numerous of these countries fall into the Least Developed Country (LDC) group, while many others belong to the group of Low-Income Food-Deficit Countries (LIFDCs).

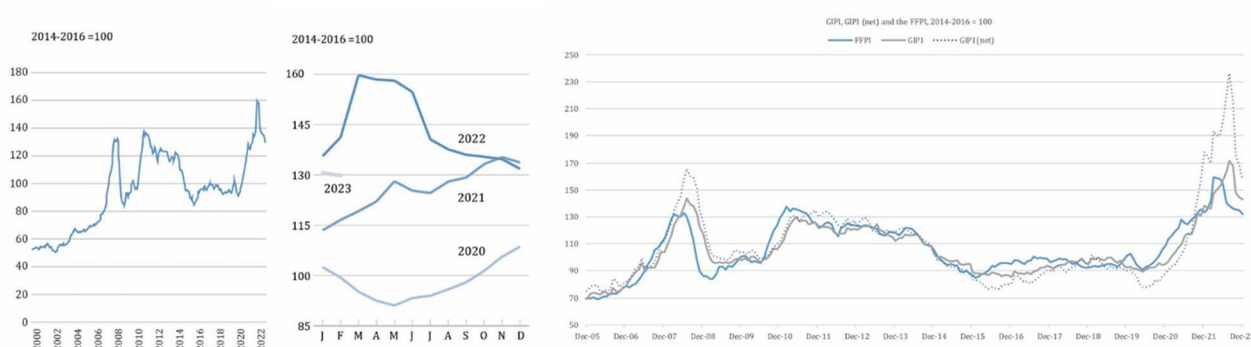
The immediate impacts of the war were spikes in the world food and fertilizer prices and a sharp reduction in grain exports by the Ukraine and the Russian Federation as Black Sea trade routes were disrupted, affecting also the procurement of crucial food supplies for humanitarian assistance (Figure 4). Nevertheless, recent WTO analysis suggests that throughout 2022 many countries were able to diversify their sources of food imports to some extent, thereby partly cushioning the impact of the shock and mitigating the consequences for food security.[15] Many of the countries hardest hit by this new shock were already suffering from previous conflict, climate, and economic shocks.

Figure 3: Wheat import dependency: Share of wheat imports from the Russian Federation and Ukraine in total wheat purchases by net importers (2021, percent)



Source: FAO. 2022. The importance of Ukraine and the Russian Federation for global agricultural markets and the risks associated with the war in Ukraine.

Figure 4: FAO Global Food Price Index (left and center panel) and FAO Global Input Price Index (GIPI) (right panel)



Source: FAO. 2023.

An early assessment of the impacts of the war in Ukraine and other developments on global food security in 2022 pointed to an additional increase of 10.7 million people facing chronic hunger compared with the pre-war baseline.[16] Millions of people that had slid into extreme poverty due to the economic slowdown caused by COVID-19 were further affected by the increase in food prices that followed the war in Ukraine. This shock hit them just as the post-pandemic economic recovery process had begun, with a potential impact on their nutrition and serious long-term implications for their health and longer-term wellbeing. This is particularly the case for the nutrition of women, young children and older people, as well as those who are disabled, with both immediate and long-term consequences particularly for poorer social groups in all nations.

The UN Secretary-General established the Global Crisis Response Group on Food, Energy and Finance (GCRG) in March 2022 to help decision-makers find global and systemic solutions to an unprecedented three-dimensional food, energy and finance crisis.[17] The GCRG estimated that 1.2 billion people live in countries affected by all three dimensions of the current crisis – finance, food, and energy – simultaneously, and issued three briefs with recommendations. These highlight the pathways through which rising food, fertilizer, and energy prices, higher interest rates, and increasing debt burdens are affecting vulnerable economies and people.[18,19] One recommendation being implemented is the reintegration of Ukrainian and Russian food and fertilizer supplies into world markets through the Istanbul Agreements, namely the Black Sea Grain Initiative, signed by the Russian Federation, Türkiye, Ukraine and the United Nations Secretariat on the Safe Transportation of Grain and Foodstuffs from Ukrainian Ports, and the Memorandum of Understanding between the Russian Federation and the Secretariat of the United Nations on promoting Russian food products and fertilizers to the world markets.[20]

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As alarming as the rise in the FAO Global Food Price Index was in 2022, it understated the economic pain inflicted upon the most vulnerable people and countries. Even though world price levels have decreased in recent months, net food importing developing countries continue to face affordability difficulties to meet their import needs. This is connected to the broader effects of both the pandemic and the war on global markets and macroeconomic conditions. The pandemic-induced economic downturn lowered the fiscal space available to many low-income countries to meet higher food and fuel import bills or to alleviate the impacts of higher costs on consumers through social programmes (Table 1). [21, 22] It was in response to this constraint that FAO put forward a proposal for the development of a Global Food Import Financing Facility (FIFF) to help countries pay for their import bills and meet their food import needs.[23] Spillover effects of monetary policies in developed economies, namely raising interest rates, put pressure on the currencies of vulnerable food importing countries to depreciate. Although food prices in world markets have decreased since their peak in the spring of 2022, the transmission of lower international prices to the domestic markets of many low-income countries is incomplete, and local food prices remain high and continue to severely hinder access to food.[24] While the global market situation may have improved over the past year, the economic situation of most low-income countries has not. The World Bank’s Food Price Inflation Dashboard shows that domestic food price inflation remains high across countries, and exceeds overall inflation in many.[25]

Table 1: Import bills of total and food products by region (USD billion)

	World				LDCs				NFIDCs				SSA			
	2019	2020	2021	2022*	2019	2020	2021	2022*	2019	2020	2021	2022*	2019	2020	2021	2022*
Animal and vegetable oils, fats	91.5	103.0	150.1	176.5	5.0	5.8	8.1	8.4	10.8	12.6	18.8	21.3	4.9	6.1	8.0	9.7
Beverages	119.7	113.3	133.8	140.1	1.6	1.7	1.7	2.0	3.3	3.1	4.0	4.8	3.0	2.1	2.8	3.0
Cereals and cereal preparations	195.1	207.2	255.5	296.4	12.1	13.1	16.8	20.0	32.2	35.0	41.2	53.7	16.1	17.0	19.5	21.7
Coffee tea cocoa spices and products	109.9	112.5	125.5	137.4	1.4	1.2	1.5	1.8	5.4	4.8	5.4	6.1	1.5	1.5	1.7	1.8
Dairy products and eggs	94.9	95.7	107.9	120.2	1.5	1.6	1.9	2.0	5.5	5.6	6.1	7.1	2.4	2.3	2.6	2.7
Fish, crustaceans, and molluscs	164.5	151.9	175.9	194.7	1.4	1.1	1.4	1.5	5.4	5.0	5.2	5.6	4.3	3.7	4.5	4.6
Meat and meat preparations	154.7	159.7	177.0	190.9	1.5	1.6	2.3	2.7	7.6	6.6	6.6	8.3	3.2	2.7	3.2	3.4
Miscellaneous food	98.5	103.9	115.3	121.3	3.0	3.5	4.0	4.0	7.2	7.7	8.8	9.2	4.2	4.2	4.9	4.8
Oilseeds and oleaginous fruits	92.4	102.5	134.0	156.1	0.7	0.6	1.8	2.3	7.0	7.5	10.2	10.8	0.2	0.2	0.3	0.3
Sugar, honey and preparations	45.3	49.5	56.8	62.7	3.2	3.6	4.3	4.0	6.2	6.5	8.0	8.9	4.2	3.7	4.3	4.2
Fruits and vegetables	284.0	294.9	323.2	339.1	4.3	4.0	4.4	4.5	10.3	11.0	11.9	12.3	2.9	2.9	3.1	3.4
Total	1 450.6	1 494.1	1 755.0	1 935.6	35.7	37.9	48.3	53.2	100.9	105.4	126.4	148.1	47.0	46.4	54.9	59.6
	HICs				UMICs				LMICs				LICs			
	2019	2020	2021	2022*	2019	2020	2021	2022*	2019	2020	2021	2022*	2019	2020	2021	2022*
Animal and vegetable oils, fats	45.1	50.8	69.7	89.0	21.2	24.8	35.6	36.4	23.3	25.2	41.3	47.6	2.0	2.2	3.5	3.6
Beverages	94.4	91.7	106.6	110.8	18.8	16.2	20.3	21.5	5.6	4.7	6.0	6.7	0.9	0.6	0.9	1.1
Cereals and cereal preparations	99.7	104.0	118.9	142.2	40.0	45.6	67.0	68.1	49.1	51.0	60.9	77.0	6.3	6.7	8.7	9.1
Coffee, tea, cocoa, spices and products	84.0	86.4	95.0	106.0	15.4	16.0	18.8	18.7	9.6	9.4	10.9	11.9	0.9	0.6	0.8	0.8
Dairy products and eggs	65.4	65.3	72.2	82.2	19.5	20.4	24.2	24.9	9.1	9.2	10.5	12.2	0.8	0.8	1.0	1.0
Fish, crustaceans and molluscs	123.1	115.9	134.6	146.1	31.7	27.2	31.0	37.8	8.8	8.0	9.3	9.7	1.0	0.8	1.0	1.1
Meat and meat preparations	110.5	106.4	117.2	129.1	33.7	44.4	49.0	48.9	9.7	8.1	9.6	11.7	0.8	0.9	1.1	1.2
Miscellaneous food	62.4	65.4	72.4	76.5	24.1	25.8	27.9	29.4	10.5	10.9	12.6	13.3	1.6	1.9	2.4	2.1
Oilseeds and oleaginous fruits	28.4	31.0	38.9	49.5	51.2	58.0	77.1	86.7	12.8	13.4	17.8	19.7	0.0	0.0	0.2	0.2
Sugar, honey and preparations	26.3	27.0	30.6	34.2	7.7	9.2	10.6	11.9	9.5	11.7	13.1	15.2	1.8	1.6	2.4	1.5
Fruits and vegetables	208.6	217.3	232.7	237.2	48.3	49.7	58.3	66.9	25.3	26.2	30.3	33.0	1.9	1.6	1.9	2.0
Total	947.8	961.2	1 088.9	1 202.6	311.7	337.4	420.0	451.1	173.1	177.9	222.3	258.1	18.0	17.6	23.9	23.7

Source: FAO. 2022. Food Outlook.

Food Security Assistance

As of March 2023, food security funding requirements are estimated at USD 18.8 billion, with 58.5 percent of funding requirements met, amounting to just under USD 11 billion.[26] Acute food insecurity continued to escalate in 2022, affecting up to 222 million people in IPC Phase 3 or above across 53 countries and territories, as of September 2022.[27,28] Among those, around 45 million people in 37 countries were projected to have so little to eat that they would be severely malnourished, at risk of death, or already facing starvation and death (IPC Phase 4 and above).[29] This was a new peak from 2021, when the number of people suffering from acute food insecurity had already surpassed all previous records, affecting close to 193 million people in IPC Phase 3 and above in 53 countries and territories.

Box 2: Acute Food Insecurity Levels

The *IPC Acute Food Insecurity (IPC AFI)* classification provides information to enable short-term actions by policy makers to prevent, mitigate or decrease severe food insecurity that threatens lives or livelihoods. The IPC Acute Food Insecurity classification differentiates between levels of severity of acute food insecurity, comprising five phases.

Phase 1 indicates *minimal to none* acute food insecurity in a population; **Phase 2** indicates *stressed*, **Phase 3** indicates *crisis* level; **Phase 4** indicates *emergency* levels; and **Phase 5** indicates *catastrophe or famine* levels. The populations that require urgent action to meet their food needs are those in Crisis (IPC Phase 3), Emergency (IPC Phase 4) and Catastrophe (IPC Phase 5). Each phase has different characteristics and requires distinct interventions. In Crisis (IPC Phase 3), households are already facing food consumption gaps which are reflected in high or above normal acute malnutrition, or are only able to minimally meet their food needs by depleting essential livelihood assets or engage in crisis-level coping. People in Emergency (IPC Phase 4) face high levels of acute malnutrition and excess mortality due to lack of food, or resort to emergency coping strategies to mitigate large food consumption gaps. For populations in Catastrophe (IPC Phase 5), households have exhausted all coping strategies and face destitution, very high malnutrition, starvation and death. For more information on the IPC classifications, see <https://www.ipcinfo.org/>

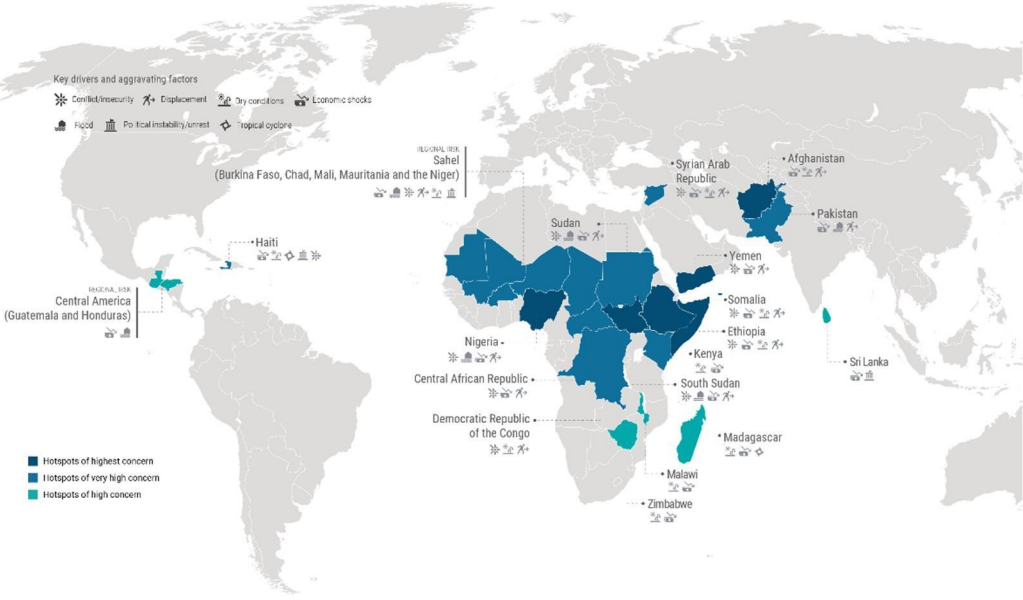
IPC Global Partners. 2021. *Integrated Food Security Phase Classification Technical Manual Version 3.1. Evidence and Standards for Better Food Security and Nutrition Decisions.* Rome.

Many of the countries experiencing the highest levels of food insecurity have suffered multiple compounding shocks. Out of 53 countries/territories affected by acute food insecurity, conflict is identified as the primary driver in 24 of these, economic shocks as the primary driver in 21, and weather extremes in 8 countries.[30]

In 2022, the number of people in acute food insecurity (IPC level 3+) in 55 countries is expected to raise by 24% if compared with the one presented in 2021. Nine countries faced important increases in the population in Crisis or worse (IPC level 3+): Nigeria, Pakistan, Somalia, Kenya, Sudan, Niger, Yemen, Malawi and Cameroon. Populations facing Catastrophe (IPC Phase 5) can be found in Afghanistan, Burkina Faso, Haiti, Nigeria, Somalia, South Sudan and Yemen. Risks of Famine were raised in 2022 in Somalia and Yemen.

As of March 2023, prospects of persisting drought in East Africa have raised serious concerns about levels of acute food insecurity, with some areas of Somalia facing a risk of famine.[31] Very early, analyses show a probability that an El Niño event may materialize in the second half of 2023, with potential huge negative impacts worldwide, including dry spells during critical agricultural seasons in Southern Africa, West Africa, and Central America’s Dry Corridor, and flooding in the Horn of Africa.[32] Map 1 illustrates early warning hunger hotspots across the world.[33] This suggests that the needs will keep climbing in 2023.

Map 1: Global Hunger Hotspots



Source: **WFP & FAO**. 2022. *Hunger Hotspots: FAO-WFP early warnings on acute food insecurity. October 2022 to January 2023 Outlook*. Rome.

Gaps in Food and Livelihoods Support

While record levels of food assistance suggest a strong response to the humanitarian impacts of rising hunger, further analysis is needed to assess the amount and effectiveness of humanitarian assistance resources in offsetting the impacts of the food-energy-finance crisis.

The annual increase in the number of people facing acute food insecurity indicates a growing gap between humanitarian assistance needs and resources available. In 2021, 83 percent of humanitarian assistance to food sectors went to food crises driven by conflict and insecurity, an increase of more than 35 percent compared to the previous year. Allocations to countries primarily affected by economic and weather shocks went down significantly.[34]

The unabated increases from 2016 to 2021 in the same countries as assessed by the Global Report on Food Crises 2022 - Mid-Year Update indicate a failure to adequately address the underlying causes of food insecurity.[35] This results in an expanding humanitarian crisis, which in turn leads to an ever-increasing share of resources being devoted to humanitarian assistance. Fragile contexts receive insufficient levels of development assistance, and less than 11 percent is devoted to the food sectors in food crisis contexts, reflecting development actors' reluctance to step up action in these contexts.[36]

The analysis of causal factors and the related financing flows is complicated by the fact that many countries are affected by multiple shocks that are mutually reinforcing, including conflicts and extreme weather conditions with direct impacts often (but not always) tending to be more localized and aggravating conditions at the local level.

Nevertheless, given the increasing share of resources devoted to conflict situations, it is reasonable to question whether the humanitarian assistance system is adequately prepared to address a future in which overlapping economic and weather shocks are more probable. The availability of adequate financial resources is a major consideration, but not the only one. Economic and weather shocks may be shorter-lived than the impacts of conflicts but reducing the susceptibility of vulnerable populations to economic and weather shocks would reduce the need for emergency assistance in response to future shocks.

The ability of the IPC to provide timely, consensus-based and context-specific information has never been more important than in the context of the current global food and nutrition crisis, driven by persistent conflict, natural disasters and high food prices. With global acute food insecurity and malnutrition on the rise, IPC is renewing its strategy and undergoing a transformation process to expand its geographic coverage and, at the same time, maintain the high quality of information that decision makers require for planning interventions in response to food and nutrition crises. To meet the unprecedented demand for actionable information for decision support to counter food insecurity and malnutrition, the IPC requires USD 48.6 million between 2023 and 2026, currently funded at only 26 percent. The USD 35.6 million required funding will allow the IPC to expand its reach, assure continued quality and improve processes of acute

food insecurity and malnutrition analyses.[37] The third IPC Global Strategic Programme (2023-2026) aims at addressing critical gaps in the coverage of food and nutrition crises and envisions a substantial geographic expansion of the IPC, borne of global demand for the IPC in every region that has also been discussed within the GCRG.[38]

Financial Needs

One of the most urgent needs arising from the limited fiscal space many countries have for responding to food price shocks is additional support for vulnerable populations. The World Bank reports a fourfold increase in the number of social protection measures announced or implemented across 170 countries in response to food price inflation since April 2022.[39] An IMF analysis of 48 countries highly exposed to food insecurity revealed that the use of cash transfers is relatively rare despite evidence showing that social protection programmes are more effective at mitigating the impacts of price shocks on the poor than subsidies.[40]

There is a need to act now to minimize the likelihood and consequences of households reducing the cost of food purchases by skipping meals or shifting consumption from highly nutritious to less nutritious foods as a way of coping with increased prices. People living in poverty need access to universal social protection and primary health-care services, which include nutritional support programmes that focus on both the prevention of acute malnutrition and its treatment. Improved access to targeted gender-responsive and nutrition-sensitive social protection is needed, particularly for women and children, including through safety nets in the form of cash and, if necessary, nutritious food.[41]

Yet the rapid acceleration of this crisis has challenged the capacity of the international community to respond. The UN Global Crisis Response Group raised concerns that the financial commitments to the World Bank and the IMF are inadequate to allow these institutions to fully utilize their rapid response capabilities. The IMF Food Shock Window provides transitory relief to countries experiencing balance-of-payments needs as a result of shocks related to the food crisis. It was envisioned as a third line of defense after increased donor funding and concessionary lending. The Food Shock Window was conceived to meet the needs of countries whose situation does not warrant an upper credit tranche (UCT)-quality programme due to the transitory nature of the shock, the urgency of needs, or because a country is not able to develop/implement a full programme. To date, six countries have been approved for programmes under the Food Shock Window. While others are in the pipeline, the number of beneficiaries is likely to be constrained by debt burden requirements and other considerations.

FAO's proposal for a Food Import Finance Facility, which preceded the establishment of the IMF Food Shock Window, should be reconsidered given the experience with the latter. The multi-dimensional nature of this crisis has highlighted the linkages between food security and financial security. Lower international food prices are not necessarily being transmitted to local markets. Macroeconomic drivers will continue to play an important role in food security in part because of the economic implications of climate change. Further analysis is needed of whether food security considerations are adequately addressed in the existing financial rapid response mechanisms. The international community must unite forces to support all countries affected by rapidly rising hunger regardless of their development status or indebtedness levels.

Given already high debt levels in many vulnerable countries, there have been calls to consider debt relief for countries with debt that is assessed as being unsustainable. One model to consider is the temporary debt service relief provided under the G20 Debt Service Suspension Initiative (DSSI) implemented at the time of the COVID-19 pandemic. The DSSI was established in May 2020 to help countries concentrate their resources on fighting the pandemic and safeguarding the lives and livelihoods of millions of the most vulnerable people. Forty-eight out of 73 eligible countries participated in the initiative before it expired at the end of December 2021. According to the latest estimates, from May 2020 to December 2021, the initiative suspended USD12.9 billion in debt-service payments owed by participating countries to their creditors.[42, 43] The DSSI did not cover debt to private creditors.

With healthy diets out of reach for 3.1 billion people and 500 million mostly poor smallholder farmers facing an uncertain future because of climate change, national policies need to support a transformation of agriculture and food systems to enable them to promote healthy lives, prosperous rural communities, and climate-resilient production.[44] The current crisis reinforces the growing call for repurposing agricultural and food policy support. Currently, most agricultural and food policy support from national governments is not effectively targeted at meeting challenges related to sustainability objectives, such as climate change and nutrition, and preparing for the future. Redirecting these resources to ignite the sustainability transition can address multiple challenges in high- and middle-income countries. Low-income countries will need access to additional concessional resources to implement their transition. In the current context of constrained fiscal space, the countries with the most urgent need for transforming food systems have the least resources available to invest. There also remains scope for better inter-agency coordination on the ground to combine investments for scaled-up impact.

While governments are expending significant amounts of public resources to support food and agriculture, more can be achieved with these resources. The different support

measures being used can distort prices, trade, production, and consumption decisions. Worldwide support to food and agriculture accounted for almost USD 630 billion per year on average over 2013–2018, and about 70 percent of this support was destined to production. About USD 111 billion were spent yearly by governments for the provision of general services to the sector, while food consumers received USD 72 billion on average every year. Most of the support producers get is through price incentives. This includes border measures on imports and exports (such as import tariffs, quotas, export taxes, bans or licensing, etc.) and market price controls (administered prices at which governments procure food from farmers, or minimum producer price policies).[45]

Import tariffs - taxes imposed on imported goods and services - are the most commonly used border measure, often employed to shield domestic producers from competition. Non-tariff measures (NTMs) are also widespread, while tariffs in agrifood trade have declined. Examples include export restrictions mostly targeting staple foods that are considered important for food security, such as rice, wheat, maize or pulses. Overall, support for agricultural production largely concentrates on staple foods, dairy and other animal source protein-rich foods, especially in high- and upper-middle-income countries. Rice, sugar, and meats of various types are the foods most incentivized worldwide, while producers of fruits and vegetables are less supported overall, or even penalized in some low-income countries.

FAO, in the 2022 edition of *The State of Food Security and Nutrition in the World* presents evidence that if governments repurposed their current composition of food and agriculture support resources to incentivize the production, supply and consumption of nutritious foods, they will contribute to making healthy diets less costly and more affordable, equitably for all. In addition, there will also be improvements towards reducing hunger and extreme poverty.

The results suggest that with the same money countries can unambiguously improve the affordability of healthy diets. This was the case for three modeling scenarios up to 2030, where simulations in which all countries in the world (i) reallocate fiscal subsidies from producers to consumers to bridge gaps in healthy consumption patterns; (ii) reallocate fiscal subsidies among producers to bridge gaps in healthy consumption patterns; and (iii) reallocate support through border price incentives (border measures and market price controls) to bridge gaps in healthy consumption patterns.

Trade-offs and negative outcomes could emerge from this repurposing in terms of GHG emissions, agricultural production levels and farm income. The magnitude and direction of the trade-offs do vary by region and income group, and therefore results and solutions will necessarily be country and context specific.[46]

Trade Measures

From the start of the war in Ukraine, the UN Secretary-General highlighted the need to restore global access to food and fertilizer supplies from Ukraine and the Russian Federation. With successful mediation by the United Nations and Türkiye, two agreements were signed in Istanbul on July 22, 2022, jointly referred to as the Istanbul Agreements. The Initiative on the Safe Transportation of Grain and Foodstuffs from Ukrainian Ports, commonly referred to as the Black Sea Grain Initiative, provided a framework for the resumption of exports of grain, other foodstuffs, and fertilizer (including ammonia) from Ukrainian ports. It allowed for the resumption of exports from three key Ukrainian Black Sea ports through a safe maritime humanitarian corridor. The agreement foresaw a duration of 120 days, renewable. In March 2023, the Black Sea Grain Initiative was further extended for an additional 60 days. Reducing uncertainty around the renewal and duration of the initiative would further contribute to market stability. To implement the Black Sea Grain Initiative, a Joint Coordination Centre (JCC) was established in Istanbul, comprising senior representatives from the Russian Federation, Türkiye, Ukraine and the United Nations.

The Memorandum of Understanding between the Russian Federation and the Secretariat of the United Nations on promoting Russian food products and fertilizers to the world markets, commonly referred to as the Memorandum of Understanding (MoU), provides assurances that the Russian Federation's exports of food and fertilizer will not be impeded by measures imposed upon the country. This has a duration of three years.

The resumption of exports of grains and other foodstuffs under the Black Sea Grain Initiative increased predictability and helped to ease global price pressures. Under the Initiative, Ukrainian grain exports recovered significantly, but Ukrainian exports for the period between January and November 2022 remained 22 percent below those seen in 2021. As of 12 March 2023, approximately 24 million tonnes of grains (predominantly wheat and maize) and other foodstuffs were exported under the Initiative.[47] According to UNCTAD, about 49 percent of maize exports were destined to developing countries, while 65 percent of total wheat cargo were destined to developing countries and least developed countries.[48] In addition to benefiting Ukrainian farmers, the agreement has allowed shipments to resume to traditional importers of Ukrainian grains, including countries in the Middle East, North Africa and sub-Saharan Africa, as well as increasing the availability of grain supplies for humanitarian assistance in Yemen, the Horn of Africa, Afghanistan and other hunger hotspots. At the time of writing of this report, ammonia exports have not resumed through Ukrainian ports.

In June 2022, at the 12th Ministerial Conference of the World Trade Organization (WTO), Members agreed on a Ministerial Declaration on the Emergency Response to Food Insecurity, the first Declaration on this topic in the Organization's history.[49] In this, WTO Members recognized the vital role trade plays in improving food security and nutrition and resolved to make progress in promoting sustainable agriculture and food systems.[50] Members also committed to take concrete steps to facilitate trade and improve the functioning and long-term resilience of global markets for food and agriculture. Members further committed not to impose export prohibitions or restrictions in a manner inconsistent with relevant WTO provisions.

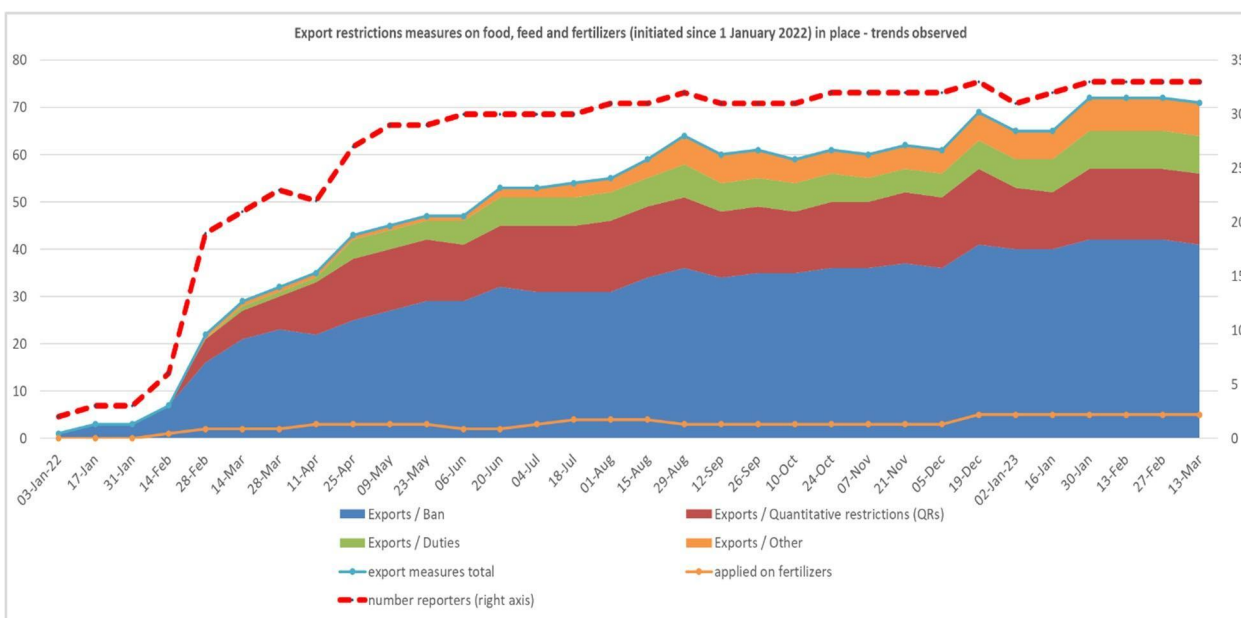
Improving market access would generally reduce the price of food and make it more accessible to poor consumers, particularly in developing countries. Likewise, the enhancement of transparency-related practices in connection with export restrictions, in conjunction with the commitment already undertaken at the 12th Ministerial Conference by WTO Members to sparingly resort to export restrictions and exempt purchases by the WFP for humanitarian purposes from such measures, would greatly enhance predictability and further improve the food security of importing countries.

Following the outbreak of the war in Ukraine, the UN, the G20, and the G7 were among the leading global voices calling for keeping international markets and trade in food and fertilizer open. They called for a resumption of exports from Ukraine and the Russian Federation and restraint in the use of export bans or restrictions that could add further volatility to markets. According to an analysis by IFPRI, export restrictions peaked in late May 2022 with measures by 23 countries covering 17 percent of global food and feed exports (on a caloric basis). By mid-July the amount of trade affected had fallen to 7.3 percent.[51] According to the WTO Secretariat, since the beginning of the war up until 14 March 2023, 100 export restrictions have been imposed on essential agricultural commodities by 29 WTO members and 6 observers. Of these, 92 applied to food and feed and 8 on fertilizer exports (Figure 5). Over the past 12 months, 29 measures have been phased out, meaning that there are currently 71 measures in force (66 on food and 5 on fertilizers) by 27 WTO members and 5 WTO observers. The export restrictions in force cover approximately USD 85 billion worth of goods.

As of 14 March 2023, the WTO had also identified 74 trade facilitating measures by importing members in respect of food, feed, and fertilizers. Whereas 66 applied specifically to food and feed, 7 to food, feed, and fertilizers combined, and one specifically to fertilizers. These measures were introduced by 62 WTO members and 2 observers (including as members of economic/customs unions). Twenty-five of these measures have been phased out, bringing the total number of currently applied measures to 49 (42 on food and feed, 6 on food, feed, and fertilizers, and one on fertilizers), imposed by 59 WTO members and 2 observers.

Tracking trade measures implemented in response to the war remains a challenge, in particular as the direct link to the crisis is becoming less clear and because measures often undergo minor adjustments on a very regular basis. The WTO's Trade Monitoring Exercise actively and regularly engages WTO Members in the verification of trade measures implemented so as to ensure the most up-to-date information is recorded.

Figure 5: Export restrictions on food, feed and fertilizers in place (initiated since 1 January 2022)



Source: WTO. 2023. *A Year of Turbulence on Food and Fertilizers Markets*. WTO Trade Monitoring Updates, 28 February 2023. Geneva.

Fertilizer Markets

Similar to global cereal exports, fertilizer exports originate from few countries, rendering world fertilizer markets concentrated and vulnerable to shocks (Figure 6). The Russian Federation is the largest exporter of nitrogenous fertilizers, the second largest supplier of potassic fertilizers and the third largest exporter of phosphorous fertilizers.[52] Most major exporting countries of nitrogenous fertilizers are also energy exporters, which is explained by the fact that its production is a highly energy-intensive process. While Ukraine did not feature as a key producer, it served as an important transit point, particularly for ammonia.

The outbreak of the war pushed the prices of energy and energy-intensive products sharply upwards, resulting in severe decline in the affordability of fertilizers. To address high prices and supply shortages, FAO has developed tools to help countries navigate

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the complexities of fertilizer markets, enhance their ability to access scarce supplies, and ensure more efficient fertilizer use with soil nutrient maps.[53] Fertilizer prices have declined by more than 40 percent since hitting record highs in nominal terms in 2022, especially due to recent drops in natural gas prices and the reopening of fertilizer plants in Europe. Though prices remain almost twice the level of two years ago, this development is welcome news for producers.

While trade volumes from the Russian Federation remained largely unaffected in the first half of 2022, those from Belarus, a major supplier of potassic fertilizer, have shrunk notably. [54] Rather resilient fertilizer exports from the Russian Federation were an important factor in containing fertilizer prices in the course of 2022.[55] Exports from the Russian Federation found new destinations in 2022, with India emerging as the largest destination market.

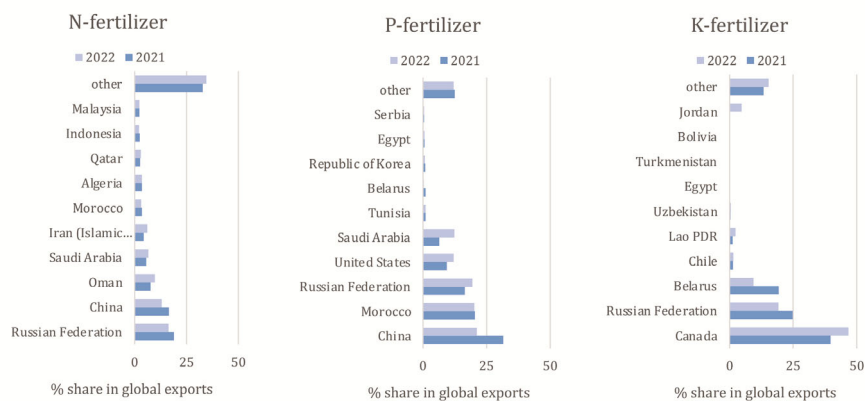
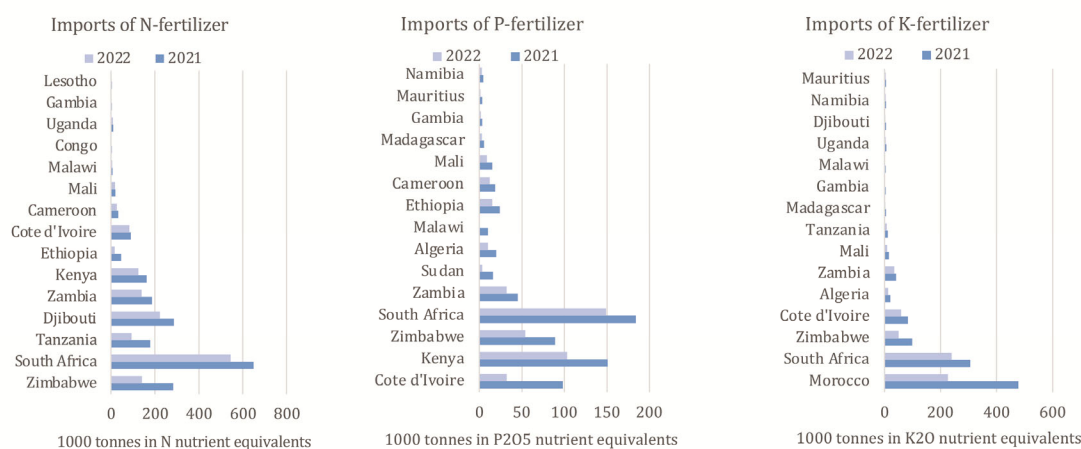


Figure 6: Global Fertilizer Supply is Concentrated in Few Countries

Source: FAO calculations based on Trade Data Monitor data.

Despite this recent decline, fertilizer prices remain elevated, albeit with notable differences between different nutrients (sharp price declines in nitrogenous fertilizers, smaller declines for potassic fertilizers). While most large food producing countries have secured their fertilizer needs for the 2022/23 season, there remains unmet import needs in many LDCs, notably in sub-Saharan Africa (Figure 7). This includes countries with already food insecurity problems such as Malawi, Zimbabwe, Tanzania or Kenya. Higher input prices translate into higher production costs, lowering the use of inputs, yields and/or quality, and eventually leading to higher food prices.[56]

Figure 7: 2022 Fertilizer Import Deficits in Selected African Countries



Source: FAO calculations based on TDM data.

The Global Fertilizer Challenge was launched by the United States of America, the European Union, and Germany, among others, at the June 17 Major Economies Forum, to raise USD 100 million by COP27 to help low- and middle-income countries address the global fertilizer shortages. As of November 2022, the Challenge had raised USD 135 million in new funding for fertilizer efficiency and soil health programs to combat fertilizer shortages and food insecurity. Of this amount, USD 109 million is new public funding that will be used to expand fertilizer and soil health programs in sub-Saharan Africa and in key middle-income countries outside the continent.

In September 2022, France launched the Save Crops Operation, which aimed at facilitating fertilizer access by vulnerable countries.[57] The initiative reiterated that fertilizers were exempt from the sanctions regime and committed to addressing potential over-compliance to sanctions by the private sector through outreach and letters of comfort. It committed to provide financial and logistical support to the Africa Trade Exchange (ATEX) mechanism to facilitate the purchase of fertilizers. The initiative also launched an emergency fertilizer purchasing mechanism to ease African farmers' access to fertilizers and facilitated donations for fertilizer procurement to Africa. Within the context of the Save Crops Operation, FAO and the WTO published a joint report on global fertilizer markets and policies, which provided a global outlook on markets, export restrictions, and

Further Actions Needed Across Fertilizer Markets

Fertilizer is one of the most complex stories to emerge from the Ukraine crisis. The disruptions in global fertilizer markets are severe, wide-ranging, and likely to continue long enough to impact multiple growing seasons. The sector's complicated structural dynamics defy easy or quick solutions. Short-term solutions to fertilizer shortages come with significant trade-offs. Supply constraints in global markets limit the ability to support any group of countries without affecting the availability of fertilizer for other countries.

In Africa, contractions in fertilizer use would have severe ramifications on the food security of some agriculture-dependent rural areas where food insecurity challenges are particularly pronounced.

Prohibitive international prices, fast depreciation of currencies against the US dollar, appreciation of the Russian ruble (which makes Russian exports more costly), high levels of indebtedness, as well as inefficient transportation and marketing infrastructure, give rise to concerns that many African countries will not be able to afford purchasing fertilizers in international markets without external support.

Food and fertilizer exports from the Russian Federation are excluded from the sanctions that have been imposed by 33 countries following the war in Ukraine.[58,59] They are also largely excluded from associated restrictions on financial transactions and transport, though restrictions on individuals and/or companies can reverberate upon these. Despite these exclusions, overall uncertainty about the application and operation of sanctions may have had a hindering effect on fertilizer trade. The United States and the EU have attempted to counteract the uncertainty through official communications and written assurances to shippers (e.g., comfort letters) clarifying the application of sanctions.[60]

More efforts are needed to reassure the private sector on this matter and thus enable the continuation of business and, where necessary, the establishment of alternative trading hubs and routes. These efforts are particularly important for the African continent that relied on European trading hubs and routes to access food and fertilizers prior to the outbreak of the war (as seen for instance in Figure 3). Such efforts should go together with actions to support importing countries to meet higher transaction costs resulting from market disruption and fragmentation. In this context, it is important to underline that the international community is well-equipped to address food crises that emerge from affordability issues, and that food crises that derive from availability constraints must be prevented.

While the IMF's Food Shock Window eligibility criteria allows countries to draw on these resources to meet rising fertilizer import costs, at the time of writing this report, only four African countries had a Food Shock Window approved. Of these, three countries had drawn on these additional funds to meet rising costs of both food and fertilizers.⁶¹ More analysis is needed to shed light on the underlying causes for apparent low response by countries to take up these funds, their policy options and choices as well as the constraints faced by African countries and to enable them to access the agricultural inputs. The African Union is organizing the Africa Fertilizer and Soil Health Summit in June 2023. The Summit will adopt a 10-year action plan to address Africa's expanding fertilizer crisis. The action plan will focus on improved efficiency, financing, fertilizer policy, and soil health. In this regard, every effort must be made to support this dialogue and the implementation of meaningful actions.

FAO has developed a "fertilizer neediness index" to inform international efforts to support and prioritize initiatives that aim to ensure that African countries are able to access international fertilizer markets, either through the provision of financing facilities to purchase fertilizers or through outright donations.⁶² This index considers a number of indicators, including country's balance-of-payment situation, the severity of food insecurity, as well as other factors that shape the ability to purchase fertilizer at market conditions.

Urgent steps need to be taken to make fertilizer more accessible and affordable. Especially within Africa, internal trade and logistics barriers raise intra-regional trade costs of African-produced fertilizer and undermine trade efficiency within the continent.⁶³ Investments in trade infrastructure and trade facilitation measures will help the regional market to function more efficiently.

For resource-poor smallholder farmers, targeted and tailored interventions are needed to provide support in weathering the crisis and planting for upcoming seasons with enough fertilizers and other agricultural inputs, while maintaining livelihoods. However, the search for longer-term solutions should also focus on increasing soil fertility and fertilizer use efficiency and reducing the environmental impact of fertilizers. There is no single solution to all soil fertility problems, but a portfolio of options can be employed. Recycled nutrient sources are alternatives to increase soil fertility. Animal manure, urban wastes, wastewater, algal biomass, compost, and digestates, among other sources, can be recycled to the plant nutrient cycle after consumption by humans or animals, as by-products of food processing or as plant residues returned to the soil. More – and longer-term – efforts and investments are needed to develop these options into viable alternatives for farmers.

Conclusions and Recommendations

The currently fragile food security situation is one dimension of a global food, energy, and financial crisis affecting every region of the world. Our humanitarian assistance system, already overstretched by ongoing conflicts and climate-related disasters, is facing even greater demands in 2023. Financial support, while increasing, has not kept pace with the needs.

The consequences of soaring inflation and mounting debt burdens are spreading the food security crisis well beyond those countries that have been suffering from acute food insecurity for successive years. Countries that were on a positive path to achieving the food security and nutrition targets of the SDGs are seeing poverty levels rise, while their ability to provide assistance to their populations is undermined by increasing debt, falling revenues, and depreciating currencies.

The global community, including the G20, has responded to the current crisis with humanitarian assistance, new initiatives and political commitments. The global response prioritized keeping food supply chains functioning, avoiding export restrictions, re-opening Black Sea trade routes, strengthening social safety nets, and continuing to invest in building sustainable food systems.

Progress has been made on all these fronts, but any additional supply shocks could turn the current food access crisis into an availability one. The main drivers of food crises – lack of adequate investments in agrifood systems and rural areas, research and development, direct impacts from conflict and insecurity, extreme climatic events, and economic slowdowns and downturns - are all expected to persist in 2023 and beyond.

A return of global economic growth will ease the crisis, but it is not sufficient either to alleviate the current suffering or to prevent future shocks from piling additional pain on vulnerable populations. Much more needs to be done to address the root causes of hunger, food insecurity and malnutrition and to make safe, healthy diets more affordable for all.

The current multi-dimensional crisis underscores the potential for global macroeconomic conditions to undermine food security and nutrition goals and the need for a swift and coordinated global financial and policy response. It is important to move beyond a sector-specific discussion of food security and consider how the development finance architecture can be improved to support investments that will address the underlying causes of food insecurity, promote sustainable and inclusive economic growth in rural areas and reduce the potential for financial stress to lead to increased hunger and food insecurity.

Recommendations

Emergency humanitarian assistance: Funding must keep pace with the needs. More funds are needed for emergency food and livelihood operations and for other emergency measures that preserve livelihoods and reduce future short-term needs.

Social safety net programmes: An integrated, people-centered policy approach is needed, which must include food-related policies. The countries with the greatest need have the fewest resources and the smallest capacity to protect vulnerable households. Social safety net programmes need to be improved and expanded to contribute towards the realization of the right to food, facilitate access to food for the poor and vulnerable, alleviate hardship and promote well-being.

Increasing resilience: Key to building the shock-absorptive capacity of an agrifood system is diversity in food sources, diversity in actors in food supply chains, including small and medium agrifood enterprises, efficient transport networks, effective early warning systems, early action plans and social protection, and affordability of a healthy diet for all households, particularly the poorest and most vulnerable.

Fertilizer: Urgent action is needed to facilitate access to fertilizers for farmers in vulnerable areas, while also increasing investment in long-term solutions. Efforts must also be deployed to improve fertilizer use efficiency, for instance by investing in and using soil nutrient maps, and reduce dependency on mineral fertilizers. The Africa Fertilizer and Soil Health Summit will be key to set priority actions for the continent, and its outcomes should be supported with concrete actions.

Finance: Countries need to be provided with fiscal space to protect their populations from the impacts of the soaring food price inflation. Donor funding, concessional loans, and emergency relief through the IMF Food Shock Window are critical. A broader food import financing facility, such as that proposed by FAO, which will expand the IMF Food Shock Window, will ease their immediate food import financing burden of vulnerable countries and help them mitigate long-lasting impacts on their agrifood systems, reducing future needs for emergency assistance. While recommendations on debt relief and restructuring are beyond the scope of this report, there is no question that such actions would provide more fiscal space to offset the impact of elevated food, fuel and fertilizer prices on poor households.

Markets and trade: Governments must take concrete steps to improve the functioning and long-term resilience of global markets for food and agriculture, including by reducing distortions, improving competition and food safety standards, and – in the longer term – ensuring that the true costs of food and farmed goods are reflected when

traded internationally. This also means strengthening the provision of public goods, for example

by improving the availability of extension and advisory services, investing in research & development, promoting access to technologies and innovation, and improving infrastructure in rural areas. In the immediate future, AMIS should be provided with adequate support to enable it to monitor world fertilizer markets and assess global supply chain logistical constraints. Regional efforts should improve market data and analysis of commodities that contribute to the affordability of healthy diets.

Governments should also enhance transparency on trade policies and measures affecting markets, exercise restraint in the use of export restrictions, and revitalize the WTO ongoing agriculture negotiations to address both short- and long-term food security challenges, while new financial tools to give policy-makers viable alternatives are also needed.

Agrifood systems transformation: We must address the underlying causes of hunger, food insecurity and malnutrition. The right investments now in transforming food systems to be more climate-resilient and less resource intensive will help to overcome the current crisis and build resilience to future crises - while responding to climate change challenge. To meet the targets of SDG 2 by 2030, agrifood systems must be transformed in ways that they deliver lower cost and safe nutritious foods that make healthy diets more affordable for all. To continue to drive poverty reduction and protect incomes and livelihoods in the face of future shocks, agrifood systems need to be more diverse, more climate-resilient and less resource intensive. Repurposing agricultural support would provide leverage to implement policies that will prompt the transformation of agrifood systems to become more sustainable and resilient and make healthy diets more affordable for all.

Endnotes:

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Nutrition for Life

Catherine Bertini

*Distinguished Fellow, Chicago Council on Global Affairs;
Former Executive Director, World Food Programme*

For every human born on Earth, proper nutrition from pregnancy until age two is vital to physical and cognitive development.

Why? This is the time that cells are created — the cells that make brains and internal organs; the cells that develop bodies; the cells that form human beings. For a person to develop properly, consistent availability of food is indispensable.

Of course, food is essential at all stages of life, but if adequate nutrition is not available in the womb and through age two, the damage cannot be made up and cells have not grown as they could. They will not have a second chance. The child will grow up stunted physically and cognitively. They will not be competitive with peers who were adequately fed. Life prospects will be more limited.

This time frame is often called “1000 days” — 270 plus 365 times two. There is an NGO of this name that was established in 2010 and that concentrates on “investments in mothers, babies, and toddlers in the U.S. and throughout the world.” In 2016, former Wall Street Journal reporter Roger Thurow wrote a book entitled *The First 1000 Days: A Crucial Time for Mothers & Children & the World*. In the book, he followed women and their babies through the mother’s pregnancy to the child’s second birthday in India, Uganda, Guatemala, and Chicago. No matter where women and their children live, the need for adequate nutrition is essential.

Congress recognized this in the early seventies when it created WIC, the Special Supplemental Nutrition Program for Women Infants and Children, in an effort to reach pregnant women and young children by providing nutritional guidance and food packages designed for each family’s individual needs. WIC is usually considered the most effective domestic nutrition program. Before WIC was available nationwide, a research project in South Carolina compared the status of children born to mothers who had access to WIC with children born to poor women who did not have access to WIC during pregnancy. The “WIC” children were born healthier — they were heavier, longer, healthier, and spent less time in hospitals compared to the “non-WIC” babies. The savings in Medicaid was significant for the “WIC” group as the newborns needed less immediate follow-up care.

We have seen this phenomenon globally in various populations, with malnutrition impacting communities beyond infancy and early childhood years. For instance, data show that some Asian and European populations were shorter pre–World War II than they are today, the result of families and entire communities moving out of poverty and into prosperity when adequate nutrition was available.

We have also seen the impact of lack of adequate nutrition on older children. One of the arguments in favor of the National School Lunch Act of 1946 was the number of young men who were rejected for military service in WWII because they were too undernourished to be considered fit for service. Even today, we hear anecdotal stories from teachers, which echo research findings, that children who eat breakfast at school have less absences and are on time more, pay attention better, and score higher on standardized testing. Many poor and wealthy school districts still report higher numbers of school meals served on Fridays and Mondays, because children are storing up food for the weekend and returning to school hungry.

Stunting and Wasting

According to the World Health Organization, “Stunting is the impaired growth and development that children experience from poor nutrition, repeated infection, and inadequate psychosocial stimulation. Children are defined as stunted if their height-for-age is more than two standard deviations below the WHO Child Growth Standards median. Stunting in early life... (and its related) impaired growth has adverse functional consequences on the children... including poor cognition and educational performance, low adult wages, lost productivity.”

“Stunting is largely irreversible: a child cannot recover height in the same way that they can regain weight. Stunted children fall sick more often, miss opportunities to learn, perform less well in school and grow up to be economically disadvantaged and more likely to suffer from chronic diseases.”

Of course, stunting has negative outcomes for every child, family, and community impacted. Imagine communities where the population is poor or living in conflict and has limited access to food on a daily basis, and therefore stunting is likely insidious and ubiquitous. Even new job opportunities and an influx of resources will have a limited impact on the population for a generation.

In his book, Thurow observes that stunting is a life sentence of underachievement, for stunted children become stunted adults. The World Bank and others estimate that the cumulative impacts of childhood malnutrition and stunting cost the global economy as much as \$3.5 trillion every year in lost productivity and health care costs. That is a huge number, but perhaps the greatest costs, such as opportunity costs, are immeasurable.

What might a child have contributed to their families, their communities, or the entire world, if they had not been stunted in the first 1,000 days? – A poem not written, a gadget not invented, a horizon not explored, a cure not discovered. A lost chance of greatness for one child is a lost chance of greatness for us all. As we see, a stunted child anywhere becomes a stunted child everywhere.

Wasting occurs when a child's weight is too low for their height, and inadequate nutrition would be the probable cause. Wasting can either be temporary or long term, but it can be fatal as wasted children are more susceptible to diseases and other dire conditions. In most cases, this condition can be eliminated with adequate consumption of nutritious food.

Food Price Impact

In the last five months, two papers have been published that summarize studies of children who were born during the last food price crisis from 2008 to 2011. This is still relevant today due to the current food price crisis caused by high food and energy costs, inflation, COVID-19 impacts, volatile climates, and the war in Ukraine. One of the papers was published by IFPRI (the International Food Policy Research Institute) in DC and the other by the University of Bonn in Germany. These two papers provide chilling data of these recent examples of stunting while reminding us that the circumstances of 2008 to 2011 are with us again now.

Researchers at the University of Bonn studied 12 countries where food availability and prices created severe food shortages from 2008 to 2011. In their paper entitled *The Fortune of Birth at the Right Time – The long-term Effects of the 2008 Food and Economic Crisis on Child Health*, several critical points were identified:

- “the results reveal a negative and statistically significant effect of utero exposure to the global food crisis on child height”;
- “children from cohorts exposed to the global food crisis in utero are significantly shorter for their age than children born after the food crisis or affected at an older age.”; and
- “these findings imply that high food prices have long-term impacts on child health, which may have an impact on future health and income...caused by a reduction in purchasing power that forces households to cut their food expenditures or their spending on other consumption goods such as health care.”

The paper also cites other sources and reconfirms:

- “poor nutrition during gestation and early childhood cause significant deterioration of health later in life”;

- “the Impairment of health adversely affects cognitive skills, economic productivity and eventually the income and well-being of adults”; and
- “childhood stunting causes significant economic losses in the long run.

The paper published by IFPRI in November 2022 entitled *Food Inflation and Child Undernutrition in Low and Middle Income Countries* studied data from 1.27 million school children in 44 countries. They investigated the connection of food inflation to childhood stunting and wasting. They found that food price increases of an average of five percent during pregnancy through age one caused increased stunting for children two to five years old, and even short-term price increases elevated the risks of increased wasting for young and older children. They emphasized the importance of maternal diet quality on the long-term health of children.

The paper also points out that with increasingly volatile international food prices, more negative childhood impacts could result due to children’s vulnerability.

Societal Roles

Food prices and availability have a clear impact on the long-term health of people. War and poverty do as well.

There are at least two additional aspects to be mentioned: (1) understanding the roles of women and specifically of mothers, and (2) educating girls, most of whom will eventually become mothers.

“Women Eat Last” was the title of my speech to the Beijing Women’s Conference in 1995 when I was executive director of the UN World Food Programme (WFP). I went on to say:

In almost every society in the world, women gather the food, prepare the food, serve the food. Yet most of the time, women eat last. A woman feeds her husband, then her children, and finally – with whatever is left – she feeds herself. Even pregnant women and breastfeeding women often eat last when of all times, they should eat first.

This is still the case more than 25 years later.

Do families know that there should be a priority for pregnant and breastfeeding women and their toddlers to eat first? This is unknown, but custom in many communities has not yet recognized the priority. The critical dependence on these mothers for adequate nutrition during these crucial months and years, one might argue that WIC-like nutrition programs could be one of the most impactful assistance programs throughout the world.

Education is and always has been a key factor in changing lives for the better and in offering training that helps prepare young women and men for the workforce. It also prepares them for life. When women in particular are educated, the results include having healthier babies and children, and these women are more likely to send their own children to school. Mothers who are educated have a better understanding of what their children need to survive and thrive.

As we learned in the U.S., food is a significant addition to schools. It helps attract students to school, helps provide the sustenance for them to learn, and it is too often the major source of nutrition for the students. In the U.S., four states have now passed laws that make school meals available at no cost to all students; similar proposals are being considered in five additional states.

Since the last food price crisis, there has been a significant increase in national school feeding programs around the world as countries have realized its benefits.

The Global Child Nutrition Foundation (GCNF), a Seattle based NGO run by a former USDA, WFP employee Arlene Mitchell, conducts global surveys on the status of school feeding in every country, and conducts training for school lunch professionals worldwide, supported by USDA. Of course, the McGovern-Dole School Feeding program sends in-kind food to school lunch programs. It has a small provision that gives cash to local programs to buy complementary items (some think that this provision could be increased to provide more flexibility to the supported schools). WFP supports government school feeding programs, and UNICEF promotes the right to learn world-wide and supports government efforts to create, expand, or improve schools.

However, the global community has not yet effectively grasped the age gap between age two and school attendance, which is covered in the U.S. by WIC and with programs like Head Start and others.

Current Responses

Millions of people are temporarily cut off from adequate food due to conflict or natural disasters. Many are reached with temporary assistance by their own governments and the international community, including UN agencies, NGOs, and the Red Cross Movement, but millions more are not. Support for development assistance for people who live in poverty but not in a sharp crisis has dropped precipitously in the last three decades. Emergencies get top priority, but long-term improvements do not.

One recent substantial U.S. emergency response has been in conjunction with UNICEF to support the distribution of RUTF (Ready to Use Therapeutic Food) to help stop wasting of severely malnourished children.

The U.S. Department of State, at the direction of Cary Fowler, Special Envoy for Global Food Security, has also initiated a new program called Vision for Adapted Crops and Soils (VACS), which plans to help develop certain highly nutritious indigenous African crops.

Potential Responses

It is in the U.S. interest to not only support those in dire living conditions due to conflict and catastrophic events (e.g., earthquakes, droughts), but also those living in poverty or those with temporary deficiencies in food availability due to price volatility. There is a need to mobilize aid programs in countries hard hit by inflationary food prices.

Ensuring that youth are engaged in productive work will be critical for global stability, as large numbers of unemployed or underemployed people can lead to unrest and cause massive disruptions. But they have to have the energy and the competence to do so.

Of course, ending war and civil conflict would have a greater impact than any developmental or emergency program could ever do.

Priority for nutrition programs includes promoting increased understanding of the importance of good nutrition for poor pregnant women and their children, bridging the gap for preschool age children, and enhancing support for school meal programs. One crucial part of development spending that has largely been missing is investment in “gray matter infrastructure” – the brains of babies and young children. Over the years, the vast majority of infrastructure spending to improve economies has been in “hard infrastructure” which includes buildings, roads, bridges, and airports. However, critical investments are needed in nutrition for the cognitive development of children, which is equally if not more important in securing the intellectual capital for a country’s future.

Conclusion

Over the long term, the impact of early childhood stunting and wasting is dramatic. Significant populations have adult work forces which cannot be as productive as their neighbors. Mothers who are stunted are unlikely to have healthy children themselves. The impacts last for at least one generation, but are in many communities, intergenerational.

Investing in mothers, infants, and children is the most important intervention possible to improve the lives of millions of people and communities forever.

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Driving Better Health Through Food Is Medicine

Devon Klatell

Vice President, Food Programme, The Rockefeller Foundation

The Current Cost of Dietary Health

Good food is the foundation of life and health. Unfortunately, far too many people globally and domestically lack access to affordable, nutritious foods, setting them up for a lifetime of chronic diseases and significantly increasing healthcare costs. The crisis of overnutrition – a form of malnutrition arising from excessive intake of nutrients leading to impaired health – is a growing global health problem and increases the risks of serious diet-related diseases including type 2 diabetes, hypertension, cardiovascular disease, and stroke. Poor diets are responsible for an estimated one in five deaths globally.^[1]

Here in the U.S., more than 140 million Americans are living with obesity, a potent risk for chronic disease. Chronic diseases, including cardiovascular disease (CVD), stroke, and diabetes, are the leading causes of death in the U.S., disproportionately affecting historically excluded communities, rural populations, veterans, and communities with low income. For example, rates of diagnosed diabetes are 1.7 times higher for Latinx Americans and 1.5 times higher for Black Americans than for White Americans.^[2]

Chronic diseases are also the principal drivers of rising healthcare costs in the U.S., accounting for 90 percent (\$3.8 trillion) of annual healthcare costs.^[3] CVD alone accounts for 12 percent of total U.S. health expenditure, considerably more than any other disease.

According to research published by The Rockefeller Foundation, human health impacts are the biggest “hidden” cost of the food system, with close to an estimated \$1.1 trillion per year in health-related costs to American taxpayers. The majority of these costs—\$604 billion—are attributable to healthcare costs related to diet-related diseases such as hypertension, cancer, and diabetes. The additional costs are impacts from health care costs from workplace injuries, food insecurity and pollution, and additional costs attributable to obesity.^[4]

Consuming an unhealthy diet, characterized by a low intake of fruits, vegetables, unrefined carbohydrates, and a high intake of sodium, added sugars, and saturated fats,

Strategies to Ensure Global Food Security

contributes to the development of chronic diseases. Availability, access, affordability, and consumption of nutritious foods across one's life cycle can help reduce the risk of chronic diseases and help treat and manage chronic diseases.

These issues point to an enormous opportunity for a collective reimagining of how we support nutrition and diet quality in the U.S.

Integrating Nutrition & Health: Food Is Medicine

There is increasing evidence that the healthcare system can be utilized to help patients access and consume healthy foods.^[5] One way this can be done is by integrating evidence-based nutrition programs such as produce prescriptions, medically tailored meals, and medical groceries into the healthcare system. These 'Food is Medicine' interventions have been shown to improve health outcomes, reduce healthcare utilization and costs, and better establish patient-provider relationships for patients living with chronic diseases.

Food is Medicine aligns with recent calls for healthcare-based interventions that address social determinants of health and achieve improvements in health equity. However, despite recognition from the healthcare community that food and health are fundamentally linked, major public and private insurance programs have not historically covered food and nutrition programs and healthcare providers have few practical tools to offer patients that suffer from poor dietary health.

Benefits: Food Security, Health, & Cost Savings

Over the last five to ten years, Food is Medicine programs have demonstrated the potential to improve health outcomes, and have been associated with reduced food insecurity, improved dietary intake, and improved mental health.

Modeling studies and pre/post-program evaluations have indicated that these programs have positive impacts on key markers of health. The Rockefeller Foundation funded a research cohort (including Tufts University, Duke University, and the University of Texas) that conducted a retrospective pooled analysis of the effectiveness of nine produce prescription (PRx) programs in 22 locations across 12 states from 2014-2020 and found:

- Significant improvement in clinical biomarkers of cardiometabolic health for adults: HbA1c blood pressure and BMI;
- Significant increase in fruit & vegetable intake; and
- Reduction in household food insecurity (odds of being food-insecure halved).^[6]

Across the board, participants, clinical staff, and community members expressed support for expanding PRx programs within healthcare settings.

Integrating nutrition into our health care system means doctors could prescribe produce or healthy meals as easily as pharmaceuticals and reduce the need for expensive and invasive health services. Modeling from existing Rockefeller grantees points further to the fiscal case for the expansion of these programs. For example, \$13.6 billion could be saved annually if all eligible Americans received medically tailored meals through the healthcare system, even accounting for the cost of the program.^[7]

Expanding innovation, utilization of, and reimbursement for these services will be critical to supporting better health and a better quality of life for those living with chronic disease.

Growing Momentum

Food is Medicine has gained significant traction in the public sector over the past six months, at both the federal and state levels. The White House Conference on Hunger, Nutrition, and Health took place in late September 2022 and accelerated several large Food is Medicine investments from both the public and private sectors. Integrating nutrition into health care, the core tenet of Food is Medicine, became the second pillar of the Biden Administration's new National Strategy on Hunger, Nutrition, and Health. Beyond the conference, Food is Medicine is increasingly becoming an area of interest and engagement for major health insurers, large employers, and media. This is a significant moment to pave the path for integrating Food is Medicine programs as covered medical benefits.

Several federal agencies have also increased activity on Food is Medicine, including the United States Department of Agriculture (USDA), Veteran's Health Administration (VHA), National Institute of Health (the NIH Office of Nutrition Research approved a new concept for "Food as Medicine Networks or Centers of Excellence"), Indian Health Services (2022 funding bill authorized \$3 million for the IHS to create a Produce Prescription Pilot program), and Centers for Disease Control and Prevention.

Additionally, in October 2022, the U.S. Department of Health and Human Services (HHS), through the Centers for Medicare & Medicaid Services (CMS), approved groundbreaking Medicaid section 1115 demonstration initiatives in Massachusetts and Oregon. The waivers will expand coverage of FIM programs across those states. Other states that currently have 1115 waivers include California and North Carolina.

Advancing Food is Medicine

For the better part of the last decade, The Rockefeller Foundation has brought together hundreds of organizations, scientific experts, healthcare professionals, and food system advocates to develop a global strategy for addressing the challenges present in our current food system. In 2022, The Foundation launched its Good Food Strategy, which will invest more than \$105 million over three years to increase access to healthy and sustainable foods around the globe.

Since 2019, The Foundation has prioritized Food is Medicine as a key impact area to support both food and health systems. We are examining the possibilities in the U.S. as a starting point, though diet-related disease – and the inability of healthcare systems around the world to respond effectively – is a growing global crisis. We are hopeful that pathways and learnings found in the U.S. will help to inform growth of the movement in more countries to come.

To further unlock the potential of Food is Medicine, The Rockefeller Foundation is investing in three key areas: (1) building high-quality evidence through research; (2) promoting policies that support the integration of nutrition incentives into health care; and (3) improving infrastructure needed to remove bottlenecks and deliver programs to those most in need.

Many of these programs have been in place for decades at a local and community level. The data collected thus far by health systems and community groups is incredibly promising. To integrate these benefits at scale and serve people across the U.S., we will need larger-scale clinical trials, and more robust and definitive evidence about the most effective program design is needed to lead to the best health outcomes across different populations and generate the most cost savings.

This is why The Rockefeller Foundation, alongside the American Heart Association (AHA) and Kroger, announced its plan at the White House Conference to mobilize \$250 million to build a national Food is Medicine Research Initiative to help improve health outcomes, reduce health disparities across communities, and reduce diet-related health care costs in the U.S. as a next step in its continued support of Food is Medicine approaches.

What's Needed

The integration of nutrition into health care services requires reaching a consensus on the parameters of a healthy diet, investing in nutrition research, and improving the nutrition education of medical providers and the public.

To ensure Food is Medicine interventions are available for more Americans we should:

- Ensure healthy food is a covered benefit under existing programs for those struggling with food insecurity or diet-related diseases;
- Expand produce prescription programs to all fifty states, territories, and Tribal Nations;
- Expand the reach of these programs in public and private healthcare systems including the Veterans Health Administration, Indian Health Service, and Centers for Medicare and Medicaid Services;
- Invest in nutrition research and improve education of medical providers and the public on nutrition.

There is a tremendous opportunity to support efforts to increase equitable access to nutritious, affordable food in the healthcare delivery system and to connect patients with insufficient resources with community service providers that will enable the adoption of healthy eating patterns. Incorporating food and nutrition programs into the health care system is an effective strategy to prevent and treat chronic diseases, lower health care costs, and improve quality of life, but only if the field can organize under unifying principles and a shared vision.

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NO TIME TO WASTE

Addressing Child Malnutrition

in the Countries Hardest Hit by the Global Food and Nutrition Crisis

Catherine Russell, Executive Director, UNICEF

Aspen Institute Congressional Program Conference
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AN UNPRECEDENTED CHALLENGE



The number of children living in food and nutrition insecurity is rising. The combined effects of conflict – including the war in Ukraine, climate-induced drought and environmental degradation, and the socio-economic impacts of the pandemic are pushing already vulnerable children into unprecedented levels of food and nutrition vulnerability.

According to the 2022 edition of the Global Report on Food Crises, there are currently 193 million people living in severely food insecure contexts (Integrated Phase Classification Level 3-5 which calls for urgent action) in 42 countries, with children under five accounting for at least 27 million. These children are particularly vulnerable to wasting – the most life-threatening form of undernutrition in early childhood, which increases children’s risk of death by up to 12 times.

Before the crisis, there were an estimated 47 million children suffering from wasting globally, 14 million of whom suffered from severe wasting. Since the start of the global food and nutrition crisis in 2022, the number of children suffering from severe wasting in the 15 worst affected countries has increased at an unprecedented speed – one additional child with severe wasting every single minute. Only 1 in 3 of the children with severe wasting receive treatment.

The world has made significant progress in improving national policies, strategies and programmes to prevent malnutrition in children as indicated by the fact that in the last two decades the global prevalence of child stunting has declined by one-third and the number of stunted children by 55 million, despite population growth. This achievement demonstrates that positive change for nutrition is possible and is happening at scale, across countries and regions.

However, in the 15 countries most severely affected by the global food and nutrition crisis, programmes and interventions are not addressing the determinants and drivers of the more life-threatening forms of child wasting. Much of the current global efforts focus on food assistance with little or no attention to the direct, underlying and enabling interventions for the early prevention, detection and treatment of child wasting, which are: nutritious and safe foods for children, essential nutrition services, positive nutrition and care practices, and financial resources in the hands of women to prevent malnutrition in children, particularly among the most vulnerable: the youngest, the poorest and those left behind by humanitarian crises.

Meanwhile, the coverage and impact of early detection and treatment services for the most severe forms of child wasting remains hampered by:

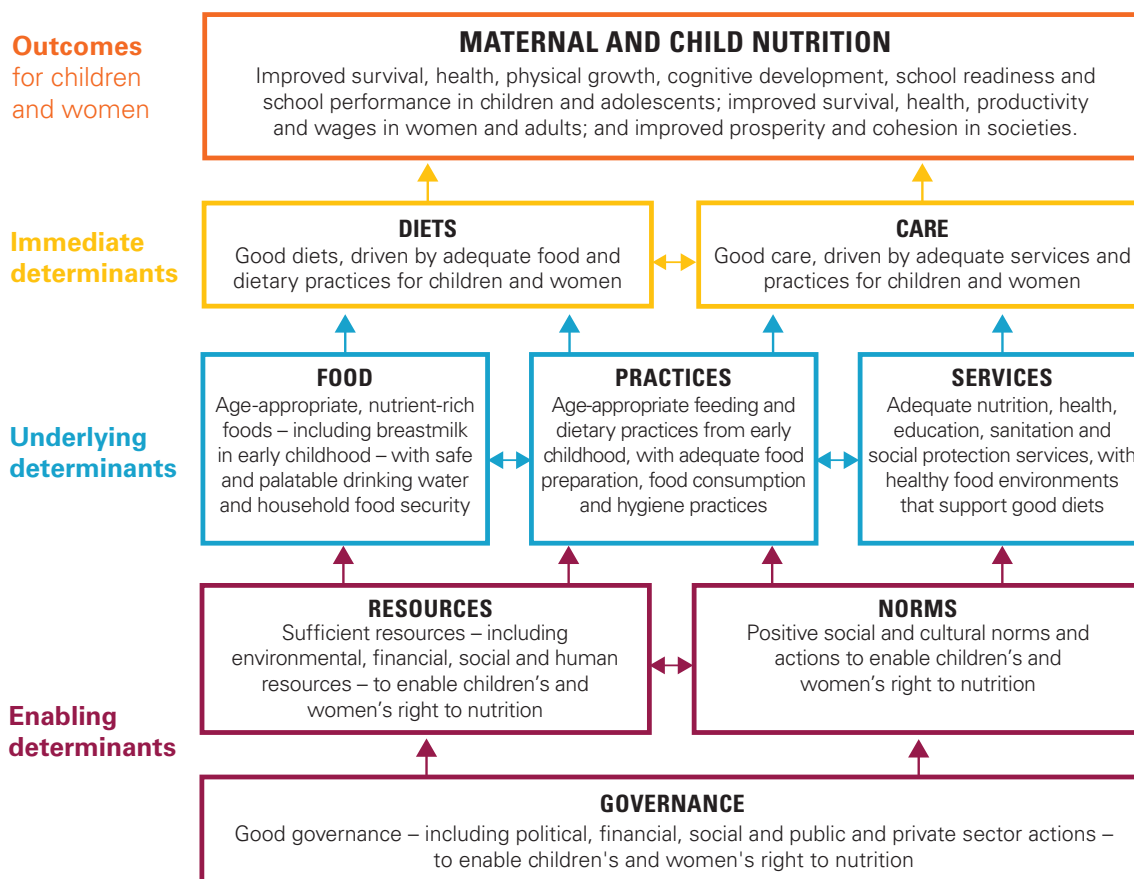
- Unnecessarily complex protocols that are not supportive of mothers and community-based workers as agents for scale and impact, able to drive a major transformation for the early detection and treatment of child wasting.
- Lack of predictable, commensurate and sustainable access to funding for programme scale up and life-saving nutrition commodities, particularly ready-to-use therapeutic food (RUTF).

The financing landscape for maternal and child nutrition makes the implementation of an appropriate response more challenging. Resources for the implementation of a comprehensive package of actions for the early prevention of child wasting in the 15 countries most vulnerable to the food and nutrition crisis are severely lacking, putting

increasing numbers of young children at high risk of severe wasting and death. To make matters worse, the cost of treatment is increasing as a result of the global crisis; recent data shows that the price of ready-to-use therapeutic food (RUTF) – the primary nutrition commodity for the successful treatment of child wasting – has increased by 16% in 2022 resulting in a potential 660,000 fewer children treated globally with available resources.

In conclusion, an unprecedented global food and nutrition crisis requires an unprecedented response that puts the most vulnerable children and women at the center of global efforts and ensures a coordinated and impactful action to protect young children and their mothers during the worst of the crisis: there is no time to waste.

UNICEF’s plan to accelerate the delivery of proven essential actions for the early prevention, detection and treatment of child wasting in the 15 countries most vulnerable to the global food and nutrition crisis is guided by UNICEF’s Conceptual Framework on the Determinants of Maternal and Child Nutrition, 2020.



The framework highlights the role of diets and care as immediate determinants of maternal and child nutrition. The Framework provides conceptual clarity on the enabling, underlying and immediate determinants of adequate nutrition, their vertical and horizontal interconnectedness, and the positive survival, growth, development, learning, economic and social cohesion outcomes resulting from improved maternal and child nutrition.



AN UNPRECEDENTED OPPORTUNITY



At a time of unprecedented need, we have a unique opportunity to demonstrate our capacity to prioritize the most vulnerable children: the youngest, the poorest and those left behind by humanitarian crises. This begins by focusing on the communities experiencing the highest impact of the global food and nutrition crisis.

According to the 2022 Global Report on Food Crises, a total of 42 countries are experiencing high levels of food and nutrition insecurity; 15 of these countries are expected to experience some of the worst impacts of the global crisis. These countries can be divided in three groups:

- Horn of Africa: Ethiopia, Kenya, Somalia, South Sudan, and Sudan.
- Central Sahel: Burkina Faso, Chad, Mali, Niger, and Nigeria.
- Countries in Crisis: Afghanistan, DR-Congo, Haiti, Madagascar and Yemen.

These countries account for 8 million children with severe wasting and 27 million children living in severe food insecurity. Further, in these 15 countries an estimated 40 million children live in severe food poverty, being fed diets that include only one or two food groups, as opposed to the five food groups that are recommended for minimum dietary diversity in early childhood (Figure 1).

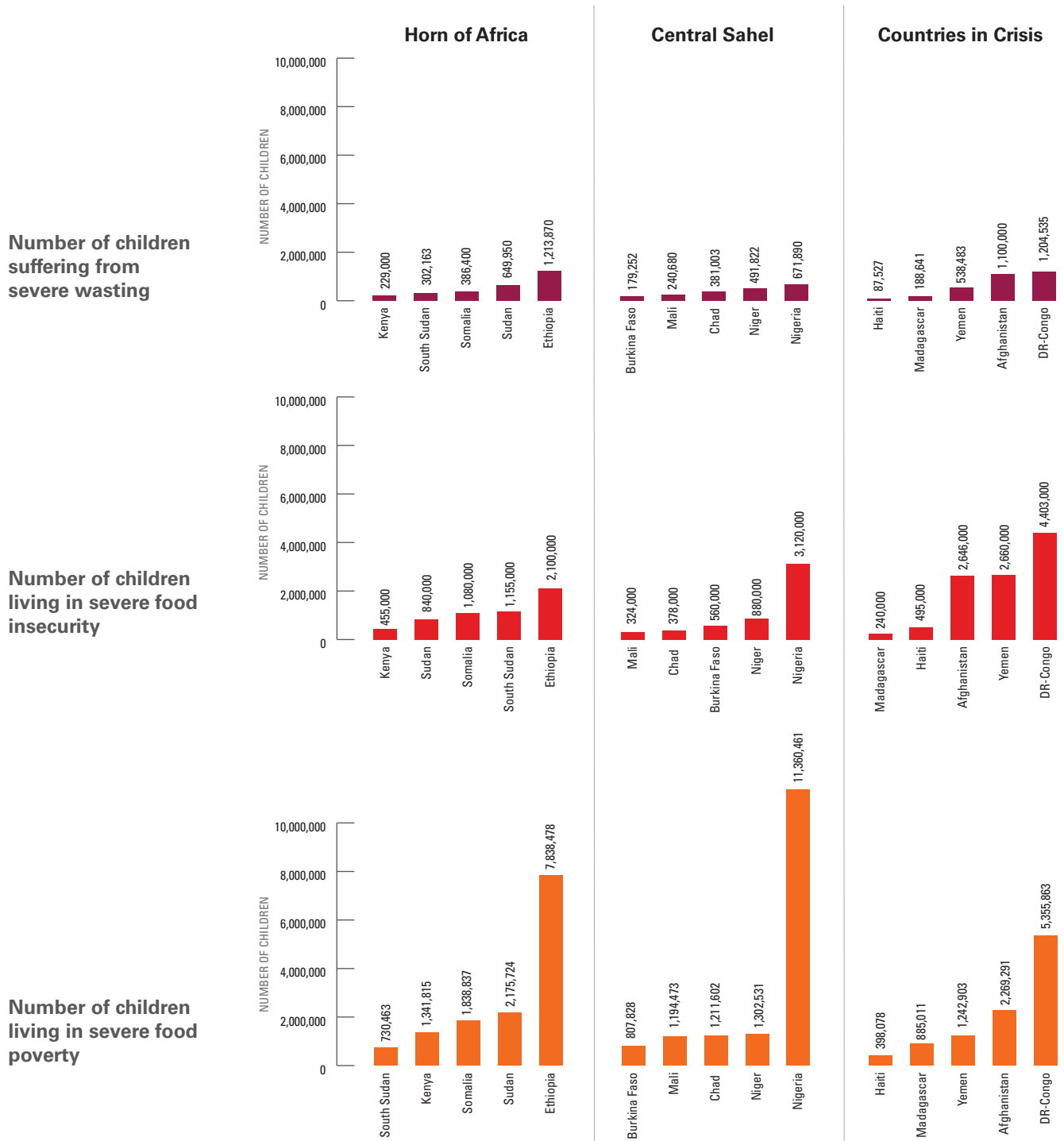
In these priority countries we have an opportunity to demonstrate the impact of a response that addresses the determinants and drivers of the food and nutrition crisis on children through the delivery at scale of a package of proven essential interventions for the early prevention, detection and treatment of child wasting.

At a global level, the conditions are ideal for mounting such a concerted effort for the most vulnerable children. In 2020, the United Nations Secretary-General launched the **Global Action Plan (GAP) on Child Wasting** – the first-ever global plan to achieve the SDG targets for the prevention of child wasting and to scale up timely treatment for children with the more severe forms of wasting.

In 2021, UNICEF launched **Nutrition, for Every Child: UNICEF Nutrition Strategy 2030**, setting forth UNICEF's strategic intent to support national governments and partners in upholding children's right to nutrition and ending child malnutrition in all its forms.

The Strategy lays out UNICEF's vision of a world where all children realize their right to nutrition, a vision guided by the Convention on the Rights of the Child, which recognizes the right of every child to adequate nutrition.

Figure 1. Estimated number of children suffering from severe wasting, severe food insecurity and severe food poverty in the 15 countries worst affected by the food and nutrition crisis.



Children suffering from severe wasting are those with a weight-for-height below minus three standard deviations and/or a mid-upper arm circumference below 115 mm and/or with bilateral oedema; children suffering from severe food insecurity and those living in areas classified as being in level 3–5 (urgent action) in the Integrated Phase Classification (IPC) of acute food insecurity; children suffering from severe food poverty are those being fed severely poor diets that include only 1–2 food groups, day in, day out, in early childhood.

Our goal is to protect and promote diets, services and practices that support optimal nutrition, growth and development for all children. This goal aims to contribute to the goal of the 2030 Agenda for Sustainable Development to end child malnutrition in all its forms and ensure that children are developmentally on track.

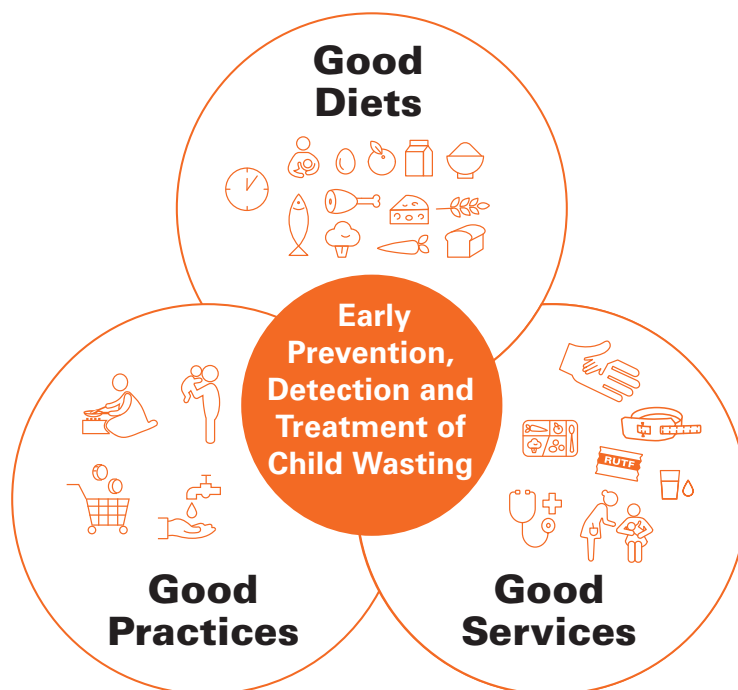
Our vision and goal are implemented through programmes that share a universal premise: prevention comes first, in all contexts; if prevention fails, treatment is a must.

Guided by our strategy, vision and goal, in 2021 UNICEF developed with the World Food Programme (WFP) a Partnership Framework for Child Wasting, with specific emphasis on children affected by humanitarian crises. The Partnership Framework is designed to streamline the collaboration between UNICEF and WFP and

increase the impact of our individual and joint actions in humanitarian contexts. The effective implementation of the Partnership Framework in the 15 countries most affected by the global food and nutrition crisis is more important than ever.

The scale of the current global food and nutrition crisis offers an unprecedented opportunity to accelerate the implementation of the commitments made by national governments and their partners in the Global Action Plan on Child Wasting: a shared commitment to prevent, detect and treat child wasting at scale and offer children and women in the 15 countries worst affected by the global food and nutrition crisis the support they urgently need: there is no time to waste.

UNICEF’s goal is to protect and promote diets, services and practices for the early prevention, detection and treatment of child wasting. This goal is aligned with the goal of the 2030 Agenda for Sustainable Development to end child malnutrition in all its forms and ensure that children are developmentally on track.





OUR STRATEGIC APPROACH



Our primary goal is to ensure that no child dies from wasting. Our approach aims to accelerate progress on two inter-related fronts simultaneously:

- **Reduce the number of children suffering from the more severe forms of wasting.**
- **Increase the number of children with severe forms of wasting who access treatment.**

To do so effectively, UNICEF and its partners will focus on four strategic results that will accelerate and improve the early prevention, detection and treatment of wasting in early childhood, with emphasis on the window of maximum nutrition vulnerability: the 1,000 days from conception to age two years.

Strategic Result 1: Identify context-specific determinants and drivers of wasting in early childhood

Contexts, communities and systems are different, and a one-size-fits-all approach to the implementation of interventions for the early prevention, detection and treatment of child wasting is ineffective.

Unpacking the context-specific determinants and drivers of child wasting and the strength of community and government systems – food, health, water, sanitation and protection systems – is essential to develop appropriate interventions to address child wasting effectively.

UNICEF with its partners will strengthen the evidence base on the context-specific determinants and drivers of child wasting and the strength of community and government systems – national and subnational – to address child wasting at scale.

This will lead to the:

- Identification of children at greatest risk of death due to the more severe forms of child wasting.
- Selection of essential interventions for the early prevention, detection and treatment of child wasting, including interventions for maternal nutrition.
- Formulation of a context-specific theory of change for the reduction of mortality associated with the more severe forms of child wasting.

Strategic Result 2: Increase access to essential actions for the early prevention of child wasting through multiple systems

To significantly reduce the number of children suffering from the more severe forms of wasting, a new approach is needed; an approach based on geographical convergence and concurrent delivery of a package of essential actions for the early prevention of child wasting. An approach that ensures the most vulnerable children and women benefit from this package of essential preventive actions designed after the analysis of context-specific determinants and drivers of child wasting and the strengths and limitations of community- and government systems.

UNICEF will support the delivery of an essential package of preventive actions to ensure that all pregnant women have access to good antenatal nutrition and care, including nutrition supplements when required; that children are born at a healthy weight and put to the breast within one hour of birth; that infants benefit from exclusive breastfeeding from birth to age 6 months; that young children benefit from adequate complementary foods – while breastfeeding continues – and nutrition supplements when required; and that children benefit from adequate feeding, stimulation, and care practices in the first two years of life and beyond.

The package includes social protection actions – including humanitarian cash transfers, for children and women. Results for SDG 1 (no poverty) and SDG 2 (no hunger) are interdependent: malnutrition in early childhood is both a cause and a consequence of poverty; likewise, poverty is both a cause and a consequence of malnutrition in early childhood. Therefore, the nexus malnutrition-poverty is bi-directional. Our Acceleration Plan will seek to leverage social protection actions to positively impact the underlying

determinants of child wasting – access to diverse nutritious foods, essential nutrition services and positive feeding and care practices – making a deliberate effort to link maternal and child nutrition and social protection actions.

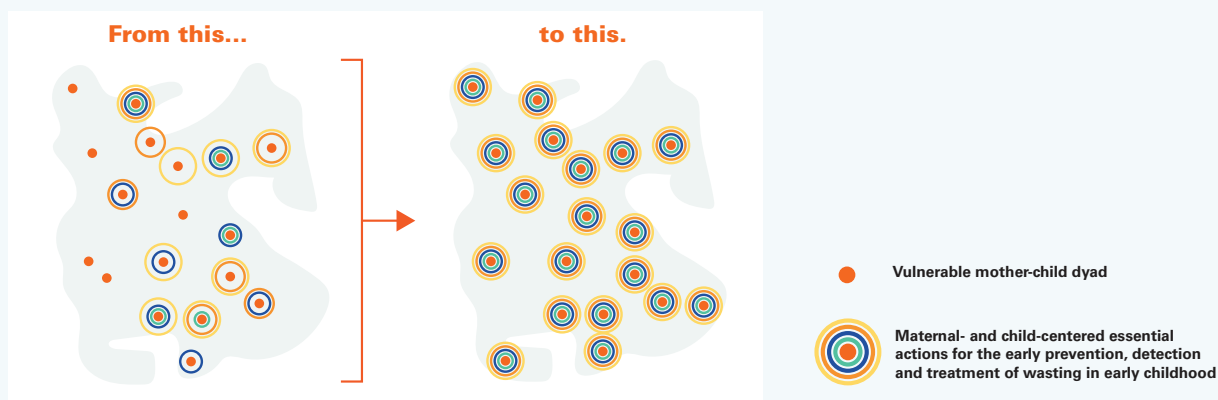
The package includes mother-child social protection measures, including cash transfers, to mitigate the impact of shocks on families and communities and facilitate financial access to the essential diets, nutrition services and feeding and care practices needed to prevent the more severe forms of wasting in early childhood. This package of essential actions for Maternal and Child Nutrition and Mother-Child Social Protection aims to strengthen the capacity and accountability of the Food, Health, Water, Sanitation and Protection systems for the early prevention, detection and treatment of wasting in early childhood. It builds on a model list of proven actions that will be adapted to the specific needs of each programming context (Table 1).

Strategic Result 3: Scale up early detection of children with wasting in homes and communities

One of the biggest barriers to accessing treatment for severe wasting early is lack of awareness by families about the early signs of wasting and lack of knowledge about where to find treatment services. Well-functioning growth monitoring and promotion platforms are an important strategy for detecting and correcting early growth faltering, ultimately preventing wasting, and referring children for treatment services where needed.

UNICEF will scale up efforts to increase the capacity of community workers, mothers, fathers and other caregivers to identify child wasting using color-coded

UNICEF Strategic approach is based on geographical convergence and concurrent delivery of a package of essential actions for the early prevention, detection and treatment of of child wasting.



mid-upper arm circumference (MUAC) measurement tapes and seek treatment services for children suffering from the more severe forms of child wasting. UNICEF will empower mothers and families in the use of this color-coded, low-literacy, low-numeracy diagnostic tool. Growing evidence demonstrates that mothers are as effective in using MUAC as health workers.

We will also generate evidence on the local impact of these tools for the early diagnosis and referral of children with severe wasting. Ultimately, we will support the wider scale-up of these low-cost tools by national governments to allow for large-scale programming.

Strategic Result 4: Optimize and simplify treatment for children with the more severe forms of wasting

There is growing evidence that treatment of medically uncomplicated wasting does not need to be provided in a health facility and can be delivered safely and effectively by trained community-based workers. Adding this community layer to facility-based services for children with medically complicated wasting significantly increases coverage and impact while reducing default rates and treatment costs.

UNICEF will actively support the scale-up of programmatic innovations to simplify the early detection and treatment of child wasting, increase the coverage of treatment services, maximize child survival and nutrition outcomes, and reduce programme costs. Based on their potential, the following 10 innovations will be prioritized:

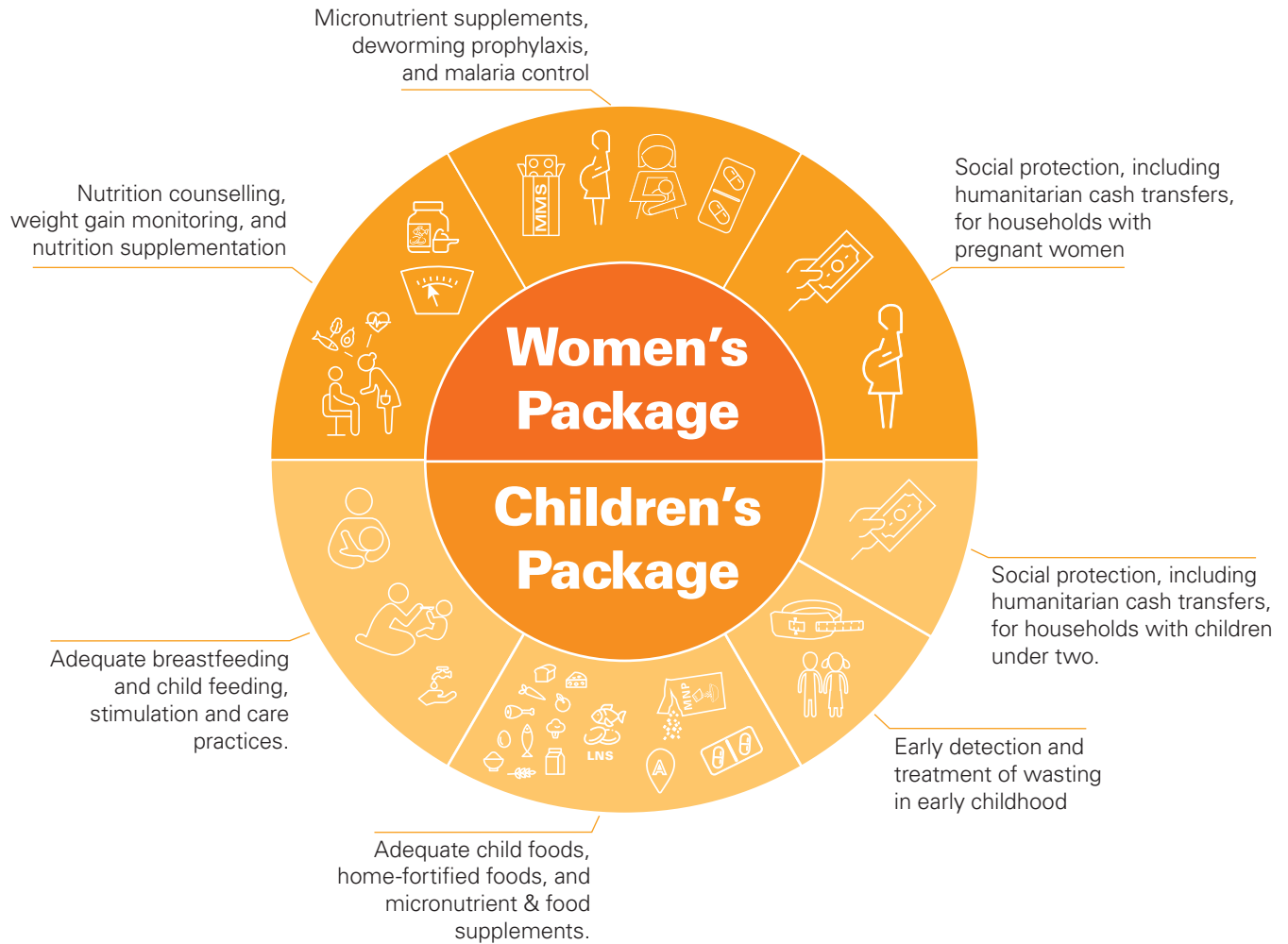
1. Focusing early detection and treatment on children under two years of age.
2. Building the capacity of mothers and families to detect wasting at home using color-coded MUAC tapes.
3. Empowering community-based workers to treat children with wasting in the community.
4. Using a single product (RUTF) for all children suffering from the more severe forms of wasting: children with severe wasting and children with moderate wasting and concurrent illnesses.
5. Optimizing the amount of RUTF used for the treatment of child wasting.
6. Implementing a single, easy-to-use criteria (MUAC) for admission to and discharge from treatment.
7. Spacing mother-child visits to therapeutic feeding sites for follow up and collection of RUTF, reducing cost to mothers (transportation costs and time investment).
8. Scaling up the use of cash transfers to complement the effectiveness of RUTF, accelerate children’s recovery and prevent relapse.
9. Integrating stimulation and play to accelerate recovery while supporting children’s brain and psycho-social development.
10. Increasing the availability and sustainability of RUTF through local production, cost reduction and innovative domestic and global financing.

In addition, UNICEF will generate new evidence on the effectiveness of innovative approaches to better understand the cumulative effect of different innovations on the effectiveness of services, and support their integration in large-scale national programmes.

Table 1. Model package of essential maternal and child nutrition and social protection actions for the early prevention, detection and treatment of child wasting

Women’s Nutrition Actions	<ul style="list-style-type: none"> • Counselling on maternal nutrition and monitoring healthy weight gain during pregnancy, with balanced protein-energy supplements for undernourished women. • Multiple micronutrient supplements, deworming prophylaxis, and malaria control for the prevention of micronutrient deficiencies and anemia during pregnancy.
Children’s Nutrition Actions	<ul style="list-style-type: none"> • Adequate breastfeeding – including exclusive breastfeeding < 6 months, complementary feeding, early stimulation, and child care practices for children aged 0–24 months. • Age-appropriate complementary foods, home-fortified foods, and micronutrient supplements, with food-based supplements for undernourished children. • Early detection and treatment of child wasting with emphasis on young children aged 0–24 months, simplified approaches and community-based programmes.
Mother-Child Social Protection Actions	<ul style="list-style-type: none"> • Social protection actions – including humanitarian cash transfers – for highly vulnerable households with pregnant women and/or children under two years of age.

Model package of essential maternal and child nutrition and social protection actions for the early prevention, detection and treatment of child wasting



The children and women we want to reach



The No Time to Waste Acceleration Plan 2022–2023 aims to reach over 26 million children and women with a package of essential maternal and child nutrition and social protection actions for the early prevention, detection and treatment of child wasting.

The Acceleration Plan will reach over 9.3 million women and 16.7 million children with essential nutrition interventions during pregnancy and the first two years of

life for the prevention, detection and treatment of wasting in early childhood.

In addition, the Acceleration Plan will aim to provide cash support to over 1.7 million pregnant women and mothers with a child under two years of age. This cash support will contribute to eliminate the financial barriers that women and children may experience in accessing nutritious diets and essential nutrition services.

Table 2: *UNICEF No Time to Waste Acceleration Plan 2022–2023*. Number of children and women to be reached with a package of essential maternal and child nutrition and social protection actions for the prevention, early detection and treatment of child wasting, by country and country grouping.

	Maternal Nutrition (Prevention)	Child Nutrition (Prevention)	Women and Children (Prevention)	Children (Detection and treatment)	Women and Children (Social Protection)
Horn of Africa	3,363,120	4,273,940	7,637,060	2,462,166	627,338
Ethiopia	1,343,280	1,679,100	3,022,380	422,763	156,795
Kenya	280,160	420,240	700,400	125,774	49,861
Somalia	452,320	565,400	1,017,720	421,643	21,638
South Sudan	273,120	341,400	614,520	443,319	31,359
Sudan	1,014,240	1,267,800	2,282,040	1,048,667	367,685
Central Sahel	3,212,600	4,355,140	7,567,740	1,019,544	337,110
Burkina Faso	277,760	347,200	624,960	76,604	109,757
Chad	234,400	293,000	527,400	294,283	2,352
Mali	576,960	721,200	1,298,160	131,411	50,958
Niger	765,920	957,400	1,723,320	151,952	17,247
Nigeria	1,357,560	2,036,340	3,393,900	365,294	156,795
Countries in Crisis	2,729,960	3,570,720	6,300,680	1,055,689	798,715
Afghanistan	907,680	1,134,600	2,042,280	133,333	406,884
DR-Congo	633,080	949,620	1,582,700	228,851	23,519
Haiti	202,080	252,600	454,680	40,735	156,795
Madagascar	328,720	410,900	739,620	37,153	27,282
Yemen	658,400	823,000	1,481,400	615,617	184,234
TOTAL	9,305,680	12,199,800	21,505,480	4,537,399	1,763,163



Costs and benefits of the No Time to Waste Acceleration Plan



The No Time to Waste Acceleration Plan aims to reach over 26 million children and women with a package of essential nutrition actions for the early prevention, detection and treatment of child wasting at a cost of 1.2 billion USD over 12 months (October 2022–September 2023).

- 459 million USD (37% of the total) will ensure the delivery of a package of essential nutrition actions to 21.5 million children and women for the prevention of child wasting at a cost of 1.8 USD per child/woman per month over 12 months.
- 408 million USD (33% of total) will ensure the delivery of a package of facility- and community-based actions for the early detection and treatment of 4.5 million children at a cost of about 90 USD per child admitted. This is in addition to the funds already mobilized to reach a total of 8 million children.
- 365 million USD (30% of the total) will ensure a cash transfer to 1.8 million women with a child aged 0–24 months at a cost of 17.3 USD per mother-child dyad per month over 12 months.

- 1.2 billion USD will ensure the delivery of a package of essential maternal and child nutrition and social protection interventions to over 26 million children and women at a cost of 3.9 USD per child-woman per month over 12 months.

Benefits of the No Time to Waste Acceleration Plan 2022–2023 for the early prevention, detection and treatment of child wasting:

- 12.2** million children reached with essential nutrition actions for the prevention of child wasting in early childhood (first 2 years of life).
- 9.3** million women reached with essential nutrition actions to prevent undernutrition and anemia in pregnancy and low birth weight in newborns.
- 4.5** million children reached with essential nutrition actions for the early detection and treatment of child wasting.
- 1.8** million children and women reached with social protection/cash assistance actions to improve access to nutritious diets and essential nutrition services

Table 3. *UNICEF No Time to Waste Acceleration Plan 2022–2023: Cost (in USD) of delivering a package of essential maternal and child nutrition and social protection actions for the prevention, early detection and treatment of child wasting, by country and country grouping.*

	Maternal Nutrition (Prevention)	Child Nutrition (Prevention)	Women and Children (Prevention)	Children (Detection and treatment)	Women and Children (Social Protection)	Total Cost
Horn of Africa	67,262,400	85,478,800	152,741,200	221,594,990	135,237,819	509,574,009
Ethiopia	33,582,000	33,582,000	67,164,000	38,048,684	12,852,823	118,065,507
Kenya	7,004,000	8,404,800	15,408,800	11,319,683	17,202,011	43,930,494
Somalia	11,308,000	11,308,000	22,616,000	37,947,884	9,736,987	70,300,871
South Sudan	6,828,000	6,828,000	13,656,000	39,898,739	9,407,717	62,962,456
Sudan	25,356,000	25,356,000	50,712,000	94,380,000	86,038,279	231,130,279
Central Sahel	80,315,000	87,102,800	167,417,800	91,759,033	54,754,170	313,931,003
Burkina Faso	6,944,000	6,944,000	13,888,000	6,894,392	12,139,091	32,921,483
Chad	5,860,000	5,860,000	11,720,000	26,485,488	649,132	38,854,620
Mali	14,424,000	14,424,000	28,848,000	11,826,974	22,014,059	62,689,033
Niger	19,148,000	19,148,000	38,296,000	13,675,719	7,533,700	59,505,419
Nigeria	33,939,000	40,726,800	74,665,800	32,876,460	12,418,187	119,960,447
Countries in Crisis	68,249,000	71,414,400	139,663,400	95,012,138	175,008,011	409,683,549
Afghanistan	22,692,000	22,692,000	45,384,000	12,000,000	76,168,643	133,552,643
DR-Congo	15,827,000	18,992,400	34,819,400	20,596,630	8,560,717	63,976,747
Haiti	5,052,000	5,052,000	10,104,000	3,666,150	36,690,098	50,460,248
Madagascar	8,218,000	8,218,000	16,436,000	3,343,798	7,529,937	27,309,735
Yemen	16,460,000	16,460,000	32,920,000	55,405,560	46,058,616	134,384,176
TOTAL	215,826,400	243,996,000	459,822,400	408,366,161	365,000,000	1,233,188,561

UNICEF’s No Time to Waste plan to accelerate actions for the early prevention, detection and treatment of child wasting in 2022–2023 has a singular objective: **ensure that children in the most vulnerable contexts make it past this global food and nutrition crisis.**

Our collective success will therefore be measured by the number of lives we protect through the scale up of essential actions for the early prevention, detection and treatment of child wasting. In delivering this combined set of essential nutrition and social protection actions, we aim to ensure that the available resources achieve higher effectiveness and greater cost-effectiveness.

Our Acceleration Plan will **strengthen the humanitarian-development nexus recognizing the immediate and longer-term benefits of our vision, goal and objectives when operating in fragile contexts.** We will be guided by the immediate need of saving children’s lives while addressing some of the structural determinants and drivers on child wasting. We will stay engaged and maintain and expand access to affected children and women through principled

action and innovative partnerships. And we will seek to understand local contexts and enable national and sub-national governments and stakeholders to lead action as much as possible.

The implementation of this plan will also **accelerate the scale up of innovative and simplified approaches for the early prevention, detection and treatment of child wasting,** maximizing the potential contribution of these solutions to survival, growth and development in early childhood. To do so, UNICEF will work closely with national governments and national nutrition sector and cluster coordination mechanisms to transform and to optimize present and future responses to food and nutrition crisis.

This coordinated effort across 15 countries will provide a unique opportunity to **operationalize the UNICEF-WFP Partnership Framework for Child Wasting.** This Framework, released in 2021, provides a clear vision and road-map to leverage the mandate, individual expertise, and operational capacity the two UN organizations.

The Partnership Framework will therefore guide UNICEF's engagement and collaboration with WFP in these 15 countries, including coordination with WFP-led food assistance interventions.

Finally, the success of this plan will need to also be measured in terms of its capacity to **accelerate changes in the way essential actions for the early prevention, detection and treatment of child wasting are financed** in the mid to long-term. By introducing innovative financing mechanisms such as UNICEF-led Child Nutrition Fund and its Nutrition Match Instrument, UNICEF aims to increase and sustain investments for the early prevention, detection and treatment of child malnutrition, everywhere.

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The Russia-Ukraine war after a year: Impacts on fertilizer production, prices, and trade flows

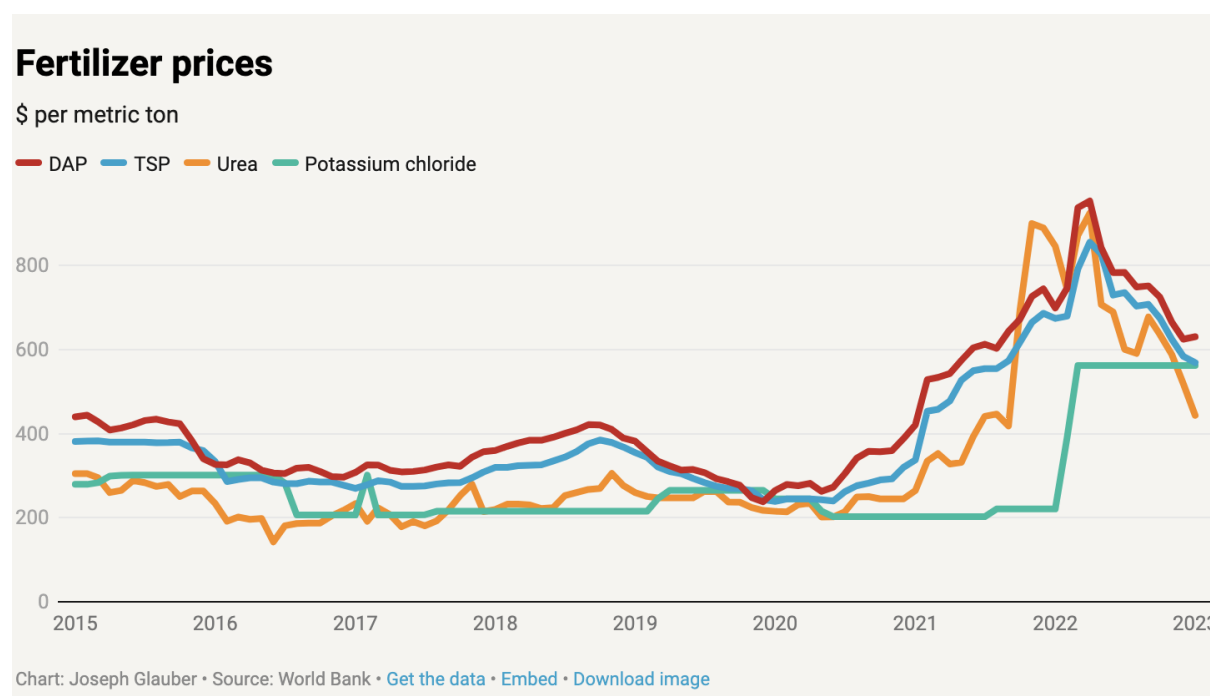
(This essay was originally published by the [International Food Policy Research Institute](#) on March 9, 2023)

Charlotte Hebebrand¹⁴ and **Joseph Glauber**

Senior Research Fellow, International Food Policy Research Institute (IFPRI);
Chief Economist, U.S. Department of Agriculture (2008-14)

Russia's 2022 invasion of Ukraine triggered global disruptions in markets for key food crops and fertilizers, threatening food security worldwide. With the war now entering its second year, high international food prices [have moderated](#), though domestic price levels remain high in many low- and mid-income countries. Here, we turn to global fertilizer markets, examining how they weathered the past year and the likely impacts going forward for agricultural production and food security.

(Figure 1):



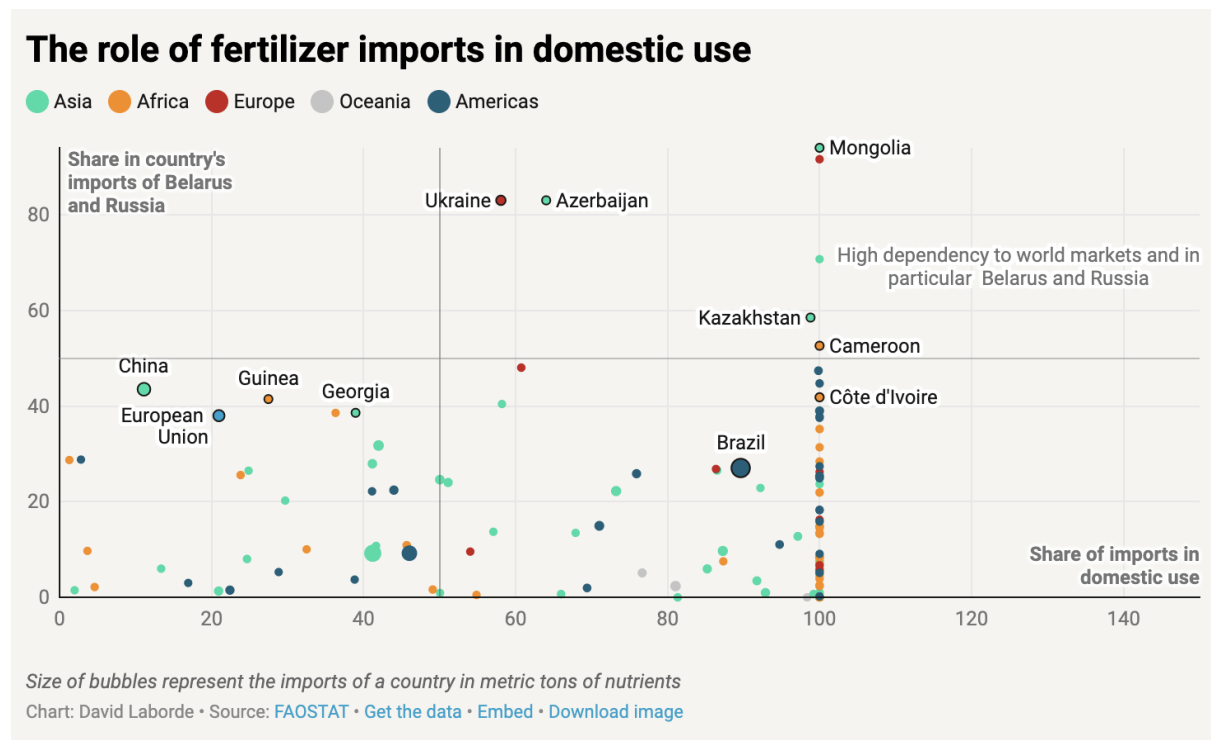
¹⁴ Charlotte Hebebrand, IFPRI's Director of Communications and Public Affairs, is not a conference participant.

The good news is that fertilizer prices, while still high, have fallen significantly from their 2022 peaks (Figure 1). As with the global trade in food crops, that rise and fall is a complex story of shifting supplies and trade linkages.

At the time of the Russian invasion, fertilizer prices were already at historically high levels. They had been rising since late 2020 due to several factors. Fertilizer demand, which declined during COVID-19 lockdowns, rebounded in late 2020/2021 as restrictions were lifted and crop prices rose. On the supply side, increases in prices of natural gas and coal—key feedstocks and energy sources in fertilizer production—as well as some reductions in production capacity also added upward pressure on prices.

Then the outbreak of war on February 24, 2022, drove prices dramatically higher. Uncertainties multiplied about fertilizer exports from Russia and Belarus due to the conflict itself, new or expanded economic sanctions on the two countries, and disruptions in Black Sea trade routes. Russia and Belarus are important producers of all three major fertilizer nutrients: In 2020, Russia accounted for 14% of global trade in urea and 11% of trade in phosphate, while jointly Russia and Belarus accounted for 41% of global trade in potash. The fact that a [small number of countries produce a large share of internationally traded fertilizers](#) makes the sector vulnerable to trade shocks.

(Figure 2):



Countries heavily dependent on fertilizer imports from Russia and Belarus feared an immediate shortfall, and many had to scramble to secure alternative sources from a very tight global market. But with some three quarters of all countries importing at least 50% of their fertilizer consumption (Figure 2), trade shocks created by the war reverberated around the world.

Post-invasion turmoil in natural gas markets and skyrocketing gas prices also contributed to rising fertilizer prices.

Sanctions, Export Restrictions and Changes in Trade Flows

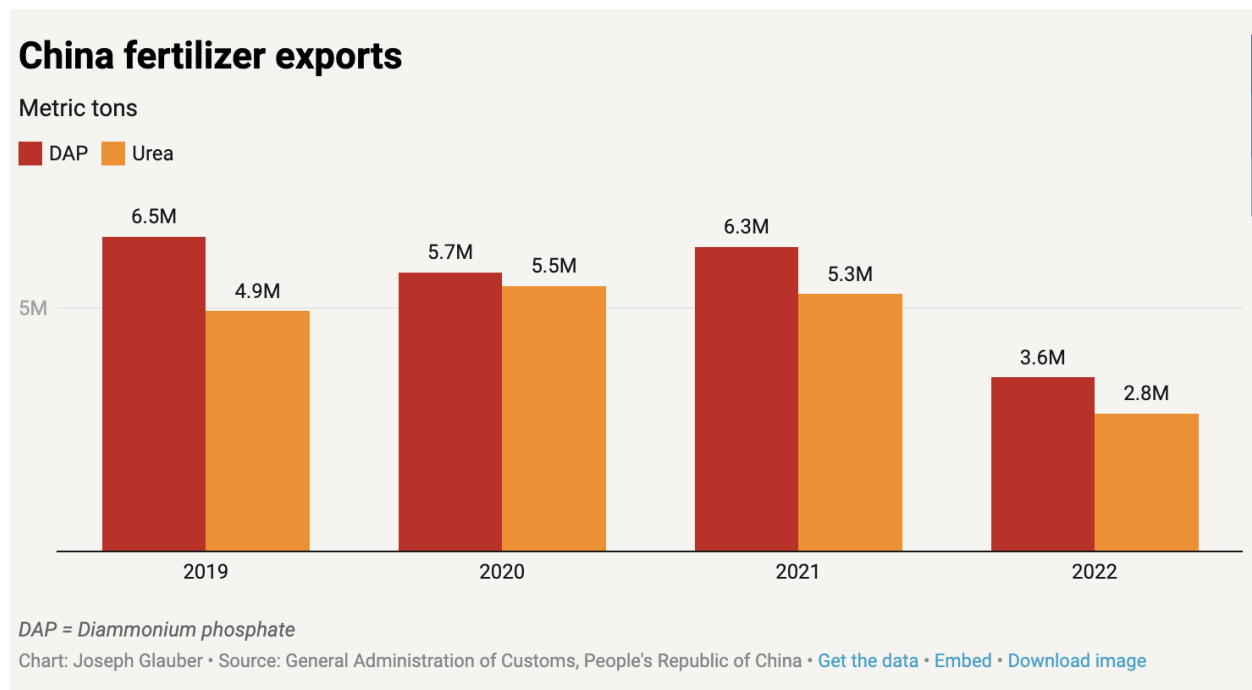
The [sanctions](#) imposed by the European Union, United States, Canada, and other countries on Russia and Belarus after the invasion—on top of earlier restrictions—formally exempt agricultural products (EU sanctions do ban potash imports from Belarus and forbid shipments of Belarussian potash through EU territory to other markets). Despite the carve-outs for agricultural products, sanctions may have led to decreased fertilizer trade to some regions, since importers may choose not to purchase from these two countries because of added costs of doing business with them, such as more restrictive banking regulations, higher insurance costs, or out of fear of being ensnared in financial sanctions.

An [IFPRI analysis](#) estimated potash exports from Belarus were at least 50% lower in 2022 than in 2021 because of the sanctions and restrictions on using EU territory for transit. While total Russian urea and potash exports were down between January-August 2022 compared to the same period in 2021, they recovered in the remaining part of the year. The shutdown of the Tolyatti ammonia pipeline to Odesa contributed to a dramatic decline of Russian ammonia exports—63% for the period January-August over 2021 (some of the decline might also be linked to “overcompliance” with sanctions).

Also disrupting global markets were various types of export restrictions imposed by some countries keen to keep domestically produced fertilizer available for domestic consumption. These included outright bans or onerous inspection and licensing processes. IFPRI estimated in June 2022 that some [20% of global fertilizer trade](#) was impacted by such restrictions.

In particular, fertilizer exports from China plunged after the country restricted exports from mid-2021 onwards. Chinese exports of diammonium phosphate (DAP), which typically account for 30% of global DAP trade, fell by 43% in 2022 compared with 2021, while Chinese urea exports declined by 47% in the same time frame (Figure 3).

(Figure 3):



Large fertilizer importers facing a shortfall from Russia and Belarus were able to [secure supplies from alternative sources](#). Brazil, for example, the second largest importer of potash, managed to increase imports from Canada to help offset the decline from Belarus; Morocco, the fourth largest global ammonia importer, stepped up imports from Saudi Arabia and Egypt to make up for shortfalls from Russia. Meanwhile, production capacities of some regions increased along with exports—in particular [potash from Canada](#) and [phosphate from Morocco](#), as well as urea from [Nigeria](#). At the same time, Russian fertilizer exports also increased dramatically in some markets, such as [India](#). However, some smaller low-income countries in sub-Saharan Africa (SSA) found it much more difficult to secure fertilizers, as they encountered problems with fertilizer availability after the invasion.

While the [International Fertilizer Association](#) (IFA) forecasts a global decline of fertilizer consumption of 5% for fertilizer year 2022, the [International Fertilizer Development Center](#) estimates that fertilizer consumption in SSA, outside of South Africa, may have declined by as much as 25%, putting the continent back to consumption levels seen in the mid-2010s.

Over the course of 2022 and into 2023, international prices eased and fertilizers became more available in global markets, but remained unaffordable in many African countries due to persistently high domestic price inflation. Even without the price pressure, fertilizer prices in Africa are generally higher than in the rest of the world, given the still significant transportation infrastructure and regulatory bottlenecks.

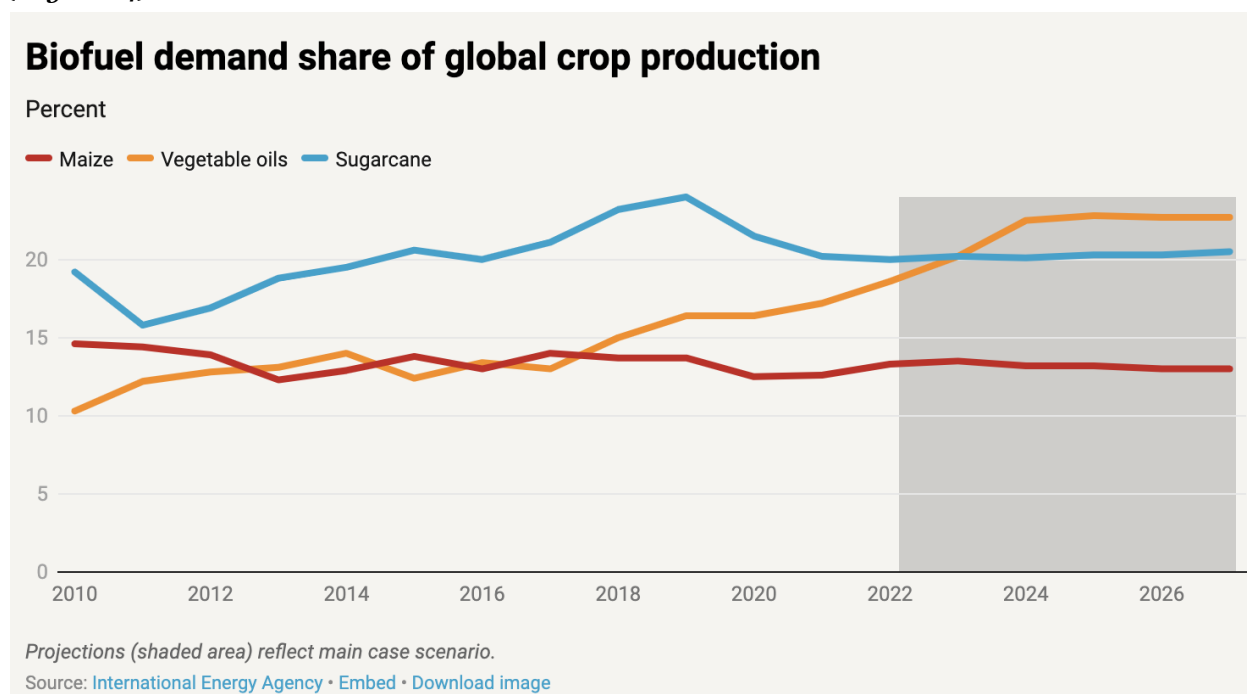
Fiscal constraints and a lack of foreign exchange created difficulties for financing more expensive fertilizer imports. Subsidy bills ballooned in some countries, and in some cases became unsustainable. However, assistance from global organizations has made a difference. International development banks including the World Bank and the African Development Bank offered financing facilities; and other initiatives, such as Sustain Africa, also supported by donations from the fertilizer industry, sprang up to help channel fertilizers to African countries in need. The [World Food Programme](#), which traditionally provides food aid, also offered its services on a full cost recovery to ship fertilizers donated by a Russian fertilizer company.

Possible Impacts on Agricultural Production and Food Security

Assessing the impact of the fertilizer crisis—in particular, reduced demand—on crop yields is a complex undertaking, especially in regions of the world with large numbers of smallholder farmers. Yield impacts vary depending not only on amounts being used but on shifting fertilizer choices. In times of high prices, farmers tend to favor nitrogen, and thus there has been a steeper global decline in demand for potash and phosphate. Yield impacts from decreased nitrogen use can be witnessed within the same growing season, while the impacts of skimping on potash and phosphate on yields, but also on soil health, may take several years to materialize.

Nor is it easy to gauge impacts of reduced fertilizer consumption on food security. Many factors affect production: climate- and weather-driven events such as droughts and floods, or high post-harvest food losses can drive down productivity even if sufficient fertilizers have been applied. Fertilizers are also used to produce non-food crops, particularly for biofuels. Global [biofuel production](#) is still increasing, albeit at lower rates since 2020, and by and large is still relying on food crop feedstocks rather than advanced non-food crop feedstocks (Figure 4). For example, [almost 38% of the U.S. corn crop](#) is used as feedstock for biofuel production, and globally, [vegetable oils](#) are forecast to account for some 23% of biofuel feedstocks by 2027.

(Figure 4):



The allocation of fertilizers in Africa, tracked for some key countries by [AfricaFertilizerWatch](#), also merits close observation. High fertilizer prices and limited supplies may push farmers to further prioritize cash crops over food crops. Cash crops such as coffee, tea, sugar, and tobacco receive a significant share of overall domestic use of fertilizers, going as high as 80% in Cote d’Ivoire and Uganda, and 90% in Mozambique. Cash crop farming can boost economic livelihoods, but does not boost food crop production. Thus it will be important to assess how farmers distributed their fertilizers in 2022.

Lower International Prices, But What Comes Next?

The high prices of 2022 led to reduced demand (or demand destruction) at the farm level, which in turn has brought prices down from their peaks of last year. But following two consecutive years of an overall 7% decline, IFA forecasts a 3% global increase in fertilizer demand in fertilizer year 2023.

Prices remain high by historical standards, however, and domestic price inflation also persists in many countries. The fertilizer sector thus remains vulnerable to further shocks arising out of the Russia-Ukraine war or other developments in an uncertain global market environment.

Capacity increases can ease supply concerns, but greenfield projects require large capital investments and long timespans to come to fruition. In 2023, new [ammonia capacity](#) is expected to come online in 2023 in the U.S. Easing China's export restrictions would also have a significant impact on global markets. Reopening the Togliatti pipeline would bring more Russian ammonia to global markets, but such a move depends on Ukrainian approval. Ongoing negotiations on the renewal of the Black Sea Grain Initiative (which expires on March 18) under UN auspices, also include discussions on the pipeline. Exports of Belarussian potash could conceivably also increase in 2023 if some EU sanction carve-outs were put into place or efforts made to end over-compliance.

While the outlook for fertilizer year 2023 is brighter than that of 2022, the fertilizer sector by its nature remains vulnerable to trade and energy shocks, and the war and other global problems continue to pose serious risks.

Meanwhile, the sector also faces significant longer-term issues that can get lost amid the contingencies of crisis response. These include the huge reliance on fossil fuels for ammonia production and the search for viable alternatives (such as green ammonia produced from electrolysis powered by renewable energy). Fertilizer continues to be used inefficiently in many regions of the world, with negative impacts on soils, water, and climate change. This problem can be addressed through improved fertilizer application, specialty and biological fertilizers, and other solutions. Organic fertilizers require more innovation and promotion for widespread use, as does integrated nutrient management that combines organic and mineral fertilizers. Plant nutrition should also be better integrated with soil health, and it is encouraging that the African Union has opted to hold [a Fertilizer and Soil Health Summit](#) in Senegal in June 2023. Overall, countries and international organizations are well advised to find a balance between crisis-oriented fixes and longer-term industry transformation.

Strategies to Ensure Global Food Security: Leveraging New Approaches for Genetic Improvement

Pamela Ronald

*Distinguished Professor, Department of Plant Pathology & the Genome Center,
University of California, Davis*

If consumption practices do not change and food waste is not reduced, meeting future food demands will require estimated food production to increase 25 to 100 %.^{1,2} At the same time, crop yield is stagnating in many parts of the world,³ and climate change threatens the worldwide agricultural system^{4,5} with yields and nutritional content predicted to decline for major crops.^{6,7,8} Additionally, crop pathogen and insect pest ranges are shifting with the warming climate into new territories towards the global poles.⁹ These challenges to global food security will require multiple solutions including social, technological and economic change.

For 10,000 years we have altered the genetic makeup of our crops to address challenges faced by farmers and desires of consumers. Today, virtually everything we eat is produced from seeds that have been genetically altered in some manner. In this essay, I provide examples of crops derived from three modern genetic approaches: (1) genetic engineering, which allows the introduction of genes from one species into another; (2) marker assisted breeding, which facilitates development of new varieties using molecular techniques; and (3) genome editing, which allows for targeted changes of DNA. Over the last thirty years, scientists and breeders have used these approaches to create crop varieties that thrive in extreme environments or can withstand attacks by pests and disease.

Because planting a new crop variety does not require extra maintenance or additional farming skills, it is a scale-neutral technology. This means that farmers of both small and large acreage, including farmers in low to middle income countries (LMICs), can benefit from new seed varieties that are tailored to their particular geography and needs.

Genetic Engineering

The process of genetic engineering has been used for more than 40 years to create life saving drugs (e.g. insulin), enzymes for cheeses (ca. 90% of U.S. cheeses are made with genetically engineered enzymes) and crops resistant to disease. After decades of careful

Aspen Institute Congressional Program

study and rigorous peer review by thousands of independent scientists, every major scientific organization in the world has concluded that the genetically engineered crops currently on the market are safe to eat and that the process of genetic engineering is no more risky than older methods of genetic alteration.¹⁰

The U.S. Food and Drug Administration (FDA), U.S. Environmental Protection Agency (EPA), and U.S. Department of Agriculture (USDA) work together to regulate most GMOs. “GMO” (genetically modified organism) has become the common term consumers and popular media use to describe a plant, animal, or microorganism that has had its genetic material (DNA) altered through a process called genetic engineering. However, the general term “GMO” is often not informative because each crop is distinct, each trait and geographic region has unique attributes and most foods do not contain entire organisms.

Virus Resistant Papaya

An important example of the application of genetic engineering is the development of papaya that is resistant to viral infection. In the 1950s, papaya production on the Island of Oahu was decimated by papaya ringspot virus. By 1995 the disease was widespread, and production fell by 50%. In 1992, Dennis Gonsalves, a local Hawaiian, and his coworkers spliced a small snippet of DNA from a mild strain of the virus into the papaya genome. Conceptually similar (but mechanistically different) to a COVID-19 vaccination, this treatment immunized the papaya plant against infection. The genetically engineered plants yield twenty times more than the conventional papaya and were distributed freely to local growers. The story of Hawaiian papayas is an example where genetic engineering was the most appropriate technology to address a specific agricultural problem. In the 1990s, there was no other technology or farming practice available to protect the Hawaiian papaya industry from this devastating disease, nor is there today.

Insect Resistant Eggplant, Maize and Cotton

One of the most widely planted genetically engineered crop are those that are engineered with the Bt gene, which originates from the soil bacterium *Bacillus thuringiensis*. The cumulative use of Bt maize, soybean and cotton crops has resulted in 37 % less global chemical insecticide use.¹¹ The protein product of the Bt gene specifically protects the plant from damage by caterpillar pests but is nontoxic to birds, fish, and humans. For these reasons, BT is a popular insecticide in the organic industry. Organic farmers apply it in a spray formulation. However, in some countries and for some crops, the sprays are expensive, hard to find, and do not prevent the insect from getting inside the plant.

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The USDA reports a 10-fold reduction in chemical insecticide sprays over the last 15 years due to planting of Bt corn.¹² Neighboring non Bt corn growers benefit from reduced application of chemical insecticides, which results in less chemical drift onto their farms as well as fewer pest infestations in the region.¹³ Cumulative benefits for Bt maize growers in Illinois, Minnesota, and Wisconsin were estimated at \$3.2 billion over 14 years. More than \$2.4 billion of this total accrued to non-Bt corn growers.¹³ In Arizona farmers who plant Bt cotton spray half as much insecticide as do neighbors growing conventional cotton. In India, Bt cotton led to a 50% reduction in pesticide application and reduced acute pesticide poisonings in cotton growers.¹⁴ Indian farmers growing Bt cotton increased their yields by 24%, their profits by 50%, and raised their living standards by 18%.¹⁵ In China, planting of Bt cotton reduced chemical sprays, increased the abundance of beneficial organisms on farms, decreased populations of crop-damaging insects¹⁶ and led to reduced insecticide poisonings of farmers and their families.¹⁷

In Bangladesh, where introduction of four varieties of Bt eggplant in 2014 marked the first genetically engineered food crop released in a LMIC and first Bt vegetable, net returns for farmers increased six-fold in part due to a 61% reduction in pesticide costs.¹⁸

It is important to note that genetically engineered seed alone will not solve all pest problems; farming practices are also important. One drawback of using any insecticide, whether it is organic, synthetic, or genetically engineered is that pests can evolve resistance to it. For example, the diamondback moth, a global pest of vegetables, evolved resistance to Bt in response to repeated sprays of Bt in fields of conventional (non-genetically engineered) vegetable crops. Based on this case, laboratory studies, and computer modeling, the EPA mandated a strategy that required farmers to plant part of their crop as non-Bt corn. This “refuge strategy” is an important element of long-term insect resistance management because it reduces selection of insecticide resistant pests.

Herbicide Tolerant Crops

Glyphosate-based herbicides (such as Roundup) have been used by farmers and home gardeners since the 1970s to control weeds. Genetic engineering was used to introduce herbicide tolerance into crops, an application that remains controversial because the crops are used in conjunction with glyphosate. When sprayed on leaves, glyphosate kill weeds but not crops engineered for tolerance to the herbicide.

Planting of herbicide tolerant crops is correlated with an increase of low-till and no-till agriculture, which leaves the fertile topsoil intact and protects it from being removed by

wind or rain.¹⁰ Because tractor-tilling is minimized, less fuel is consumed, and greenhouse gas emissions are reduced.

The popularity of herbicide tolerant crops and glyphosate has spurred the evolution of herbicide-resistant weeds. These studies highlight the fact that application of glyphosate (or other herbicides) should not be relied on solely to the exclusion of other weed control measures. Rather than applying a single herbicide repetitively over large areas, agronomists and weed control specialists advocate an integrated pest management strategy to mitigate the development of resistance to a single herbicide.

Golden Rice

According to the World Health Organization (WHO), Vitamin A deficiency (VAD) is the main cause of preventable blindness in children. The WHO has endeavored to mitigate this problem for more than 50 years through distribution of Vitamin A pills and gardening programs to promote growing of nutrient rich vegetables. Despite such efforts, an estimated 250 million preschool children remain Vitamin A-deficient and an estimated 250,000 to 500,000 Vitamin A-deficient children become blind every year, half of them dying within 12 months of losing their sight. As a complementary approach to supplementation programs, which often do not reach the rural poor, the Rockefeller Foundation supported the development of “Golden Rice” varieties enriched with Beta carotene (the nutrient found in carrots and other foods that the human body converts to vitamin A) through genetic engineering. The positive effects of Golden Rice are predicted to be most pronounced in the lowest income groups, and at a fraction of the cost of current supplementation programs.¹⁹ In 2022, farmers in the Philippines harvested a substantial amount of Golden Rice for the first time—a total of sixty-seven tons from seventeen fields and will be distributed to mothers and preschool children who are at risk for VAD.

Marker Assisted Breeding

Modern genetic analysis also facilitates a process called marker assisted breeding. In conventional breeding, large populations of plants are screened for the desired trait, usually over multiple generations (7-10 years). This is a labor-intensive and time-consuming process. In marker-assisted breeding, DNA of the individuals of a population are examined to identify the desired genetic compositions. Only lines with desired combinations are followed, speeding up the pace of breeding.

An exciting example of how marker assisted breeding has been applied is the story of Sub1 (Submergence tolerance 1) rice. Rice grows well in standing water, but most

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varieties will die if they are submerged for more than three days. In South and Southeast Asia where many farmers and their families live on less than \$3 per day, four million tons of rice- enough to feed thirty million people- is lost every year to flooding. The Intergovernmental Panel on Climate Change predicts that flooding will increase as the climate changes.

My colleagues and I used a combination of DNA sequencing, genetic engineering, and marker assisted breeding to develop rice varieties with the Sub1 gene that are tolerant of 14 days of flooding.²⁰ In each of the six years from 2008 to 2015, farmers in Bangladesh and India were able to harvest 60% more grain from the Sub1 varieties compared to the conventional varieties under flooded conditions. The generation and planting of Sub1 rice especially benefited minority social groups who have historically cultivated flood-prone plots of land.

Genome Editing

Since 2012, genome editing has emerged as another important tool for plant breeders. This approach can be used to create mutations in specific genes, delete genes, or insert genes. According to Dr. Jennifer Doudna, Professor of Chemistry and of Molecular and Cell Biology at UC Berkeley, and one of the two scientists who were awarded The Nobel Prize in chemistry for developing high-precision genome editing, this system can be used “in much the way that you would use your word processing program to change a typo in a document.”²¹

Genome editing is based on a DNA targeting and editing system discovered in bacteria. To create a mutation, scientists synthesize a single stranded molecule (called a guide RNA) that will target specific regions of the double-stranded DNA. When the guide RNA binds to the target region on the DNA, it recruits a bacterial enzyme to cut the DNA to generate a break. Organisms have evolved cellular mechanisms to repair the damaged DNA by connecting the two broken ends. During the repair process, errors often occur, introducing mutations near the original break point. Scientists make use of the endogenous error-prone repair mechanism in the cells to introduce mutations in genes of interest.

After the mutations are created, the guide RNA and bacterial DNA-cutting enzyme can be removed from the plant, so that the only modification left is the targeted mutation. The engineered organisms contain no “foreign” DNA. This is a major difference compared with genetic engineering. Still, the breadth of beneficial traits possible with genetic engineering is far greater than can be achieved through genome editing alone in part due to the wide genetic diversity that can be utilized, including across species with

innate reproductive barriers. Thus, genome editing serves to complement but not replace other strategies such as genetic engineering.

Genome editing has already been used to generate a mushroom with reduced browning, maize plants with enhanced starch content, higher yielding tomatoes, and dairy cows without horns.²²

Further Considerations

New genetic technologies present an unprecedented opportunity to identify genes controlling agronomically valuable traits and speed the development of genetically improved crops. Still, the lag time between fundamental research advances and commercialization is often lengthy. For example, the timeline for commercialization of genetically engineered varieties, which is affected by a diverse array of political and socioeconomic concerns, can span decades,²³ making it difficult to address urgent agricultural concerns. Consequently, in many parts of the world, breeders and farmers do not have access to genetic engineering technologies. For example, while farmers in Bangladesh continue to adopt and cultivate Bt Eggplant, the varieties remain prohibited in neighboring India despite scientific support and similar farmer need.²⁴ Similarly, organic farmers do not have access to Bt and other engineered varieties because genetic engineering techniques are excluded from use in certified organic production,²⁵ (although other types of genetic alteration such as mutation induction through chemicals and radiation are permitted).²⁶

The application of genome editing in agriculture has been met with mixed support among the general public,²⁷ and regulation of genome-edited products differs across the globe.²⁸ For example, in the European Union, the products of genome editing are regulated as “genetically modified” according to a 2018 decision by the Court of Justice of the European Union,²⁹ a designation that complicates European scientific field trials for genome edited plants and restricts farmer adoption.³⁰ In contrast, the USDA does not plan to regulate genome edited crops as long as they are not plant pests or developed using plant pests.³¹ This decision potentially saves years or even decades in bringing new varieties to U.S. farmers.³⁴ The USDA National Organic Program (which develops the rules and regulations for the production, handling, labeling, and enforcement of all USDA organic products) has not yet ruled on the use of genome editing technologies in certified organic production and there is disagreement on how to proceed. For instance, whereas the National Organic Program Standards Board (a federal advisory board made up of 15 volunteers from the organic community) has recommended that genome editing technologies be disallowed, researchers in the U.S. and Europe have called for the allowance of such technologies in organic farming systems.^{32, 33, 34}

These examples reflect the need for ongoing engagement of the scientific community with diverse stakeholders, including consumers and politicians, on the challenges faced by farmers and the use of plant biotechnologies to address these challenges. As described by scientists Scheufele and Krause,³⁵ the increasingly polarized political environments, and fundamental changes in how information is shared have given new urgency to the problem of the disconnect between public opinion in the United States and the scientific consensus on scientific topics.

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Public and Private Agricultural Research Policy at Home and Abroad

Robert Paarlberg

*Associate, Harvard Weatherhead Center;
Professor Emeritus of Political Science, Wellesley College*

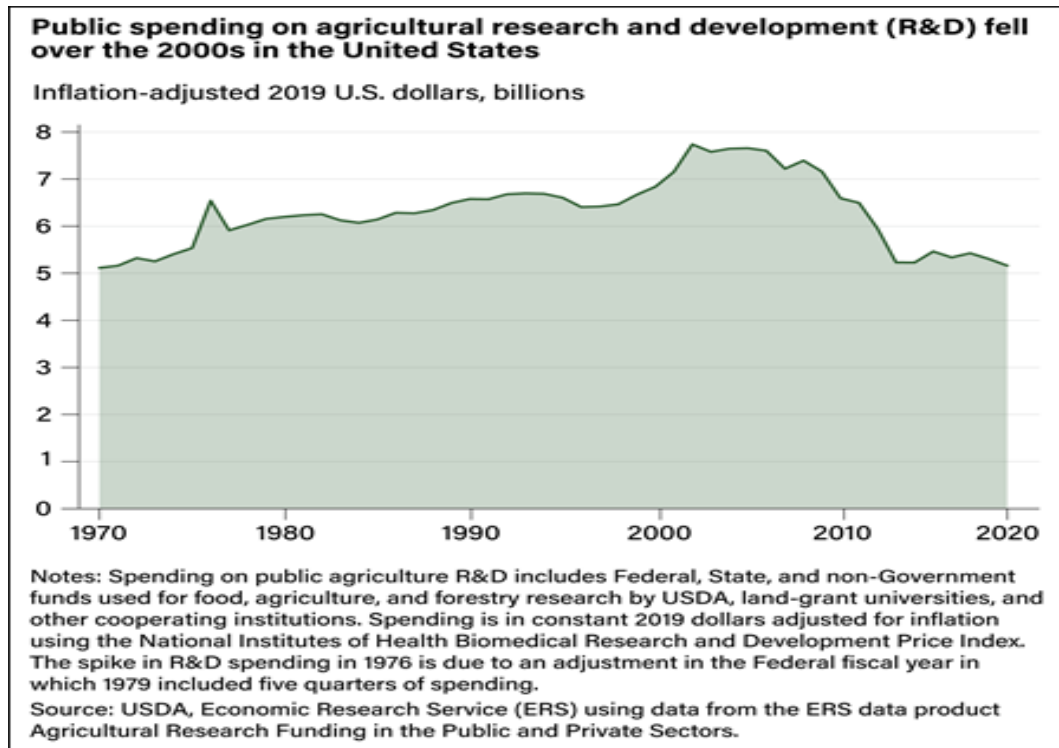
In a famous essay in 1798, Thomas Malthus predicted that—due to limited land availability—global food production could never keep pace with population growth. This prediction was badly mistaken; it underestimated the power of agricultural science. In the United States today, thanks to agricultural science, we are producing five times as much corn as we did in 1940—on 20 percent *less* land.¹⁵ Farmers can produce so much more on less land today thanks to science breakthroughs such as synthetic nitrogen fertilizer, hybrid seeds, drip irrigation, GPS auto-steering for field equipment, digital soil mapping, powerful optics for remote sensing, and much more.

Agricultural science breakthroughs require steady investments in basic research, usually funded by governments, but the social and economic returns on these investments are very large. In one literature survey, Alston et al. found a median estimated *annual* rate of return of 48 percent on public agricultural R&D spending. Huffman and Evenson reviewed studies covering the 1965-2005 period and found an average *annual* social rate of return of more than 50 percent.¹⁶

Given these large payoffs, it is frustrating to see that public investments in agricultural R&D have recently declined in the United States. A June 2022 report from USDA's Economic Research Service (ERS) revealed that investments in U.S. public agricultural R&D had fallen over the past two decades by roughly one-third. The figure below shows this decline since 2002, measured in constant 2019 dollars:

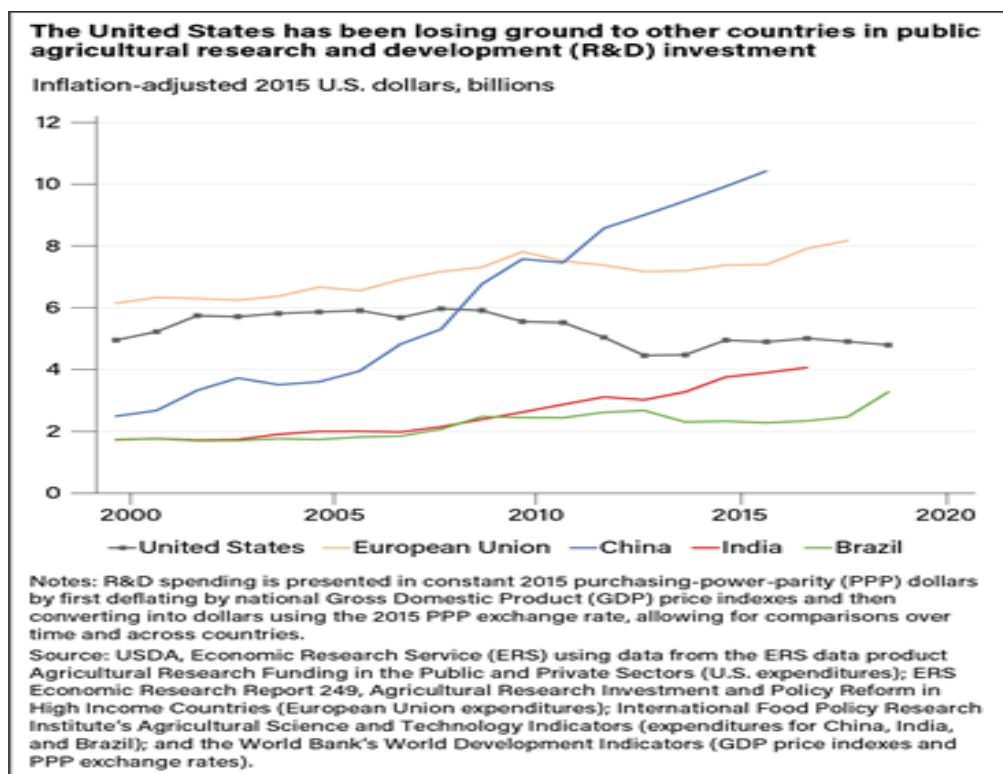
¹⁵ Ausubel, Jesse, 2015. "The Return to Nature, Breakthrough Institute," May 12, 2015. https://thebreakthrough.org/images/elements/Figure_1.png

¹⁶ Wang, S., et al. 2017. Benefits of Public R&D in US Agriculture. *Theoretical Economic Letters*. Vol. 7, No. 6. https://file.scirp.org/Html/24-1501258_79997.htm



While U.S. investments were falling by one-third, public agricultural research spending in the European Union (EU), India, and Brazil continued to increase. In China, public agricultural R&D grew so much that this country now surpasses both the EU and the United States.¹⁷ The figure below is a comparison among countries in constant 2015 dollars. The top line in 2015 is China; the next highest line is the European Union; and the declining dotted line is the United States:

¹⁷ Kelly P. Nelson and Keith Fuglie, “Investment in U.S. Public Agricultural Research and Development Has Fallen by a Third Over Past Two Decades, Lags Major Trade Competitors,” *Amber Waves*, ERS, USDA, June 6, 2022.



These comparisons among countries are misleading in one respect: they do not take private R&D investments into account. Private spending may be minimal in China's state-led economy, but in the United States private agricultural firms are making investments in R&D that now exceed those of the government, so some of China's apparent lead disappears if public and private investments are counted together.¹⁸ In rich countries growing private R&D can offset some decline in public R&D, but this doesn't work so well in low-income countries, for reasons to be explained below.

The Role of Congress

It is Congress that provides funding for most of America's public agricultural science, through the research title (Title VII) of the farm bill that is reauthorized every five years. Within USDA, Title VII covers the National Institute of Food and Agriculture (NIFA), the Agricultural Research Service (ARS), the Economic Research Service (ERS), and the National Agricultural Statistics Service (NASS). It also covers agricultural extension and

¹⁸

<https://www.ers.usda.gov/data-products/agricultural-and-food-research-and-development-expenditures-in-the-united-states/>

education at the nation's 76 land-grant universities (LGU). Between farm bills, most of these programs also require discretionary annual appropriations.

An effort was made in the Senate in 2021 to reverse the recent decline in public agricultural research funding, through the introduction of a bipartisan America Grows Act (S.1371), which would have steadily increased funding for all four of USDA's research agencies over the decade ahead, while also exempting such funds both from sequestration and from Pay-As-You-Go rules.¹⁹ This Act was modeled after the successful 21st Century Cures Act passed in 2016, which spurred additional funding for the National Institutes of Health (NIH). The America Grows Act enjoyed broad support from no fewer than 139 agricultural and educational institutions, but it never emerged from the Senate's Agriculture Committee.

Explaining this lapse in Congressional enthusiasm for farm science funding since 2002 is not easy. The lapse cannot be blamed on political opposition to all public research, since science funding through NSF and NIH has not lagged as much as for USDA.²⁰ The funding lag did coincide with a redirection of USDA spending away from steady "capacity" grants to the LGU system, and toward peer-reviewed "competitive" grants instead, and it was worsened in 2012-13 by a Congressional move away from earmarking, and by a damaging sequestration episode.²¹ Yet at a deeper level the slump reflects the damaged reputation of science-based farming today in the eyes of so many non-farmers. For the past several decades, prominent opinion leaders in the media who do not come from farm country have been labeling modern commercial farming as "unsustainable." These critics have been calling for a return to small, traditional, diversified farms, in the belief that this would reduce the environmental damage done by farming.

Agricultural scientists, agricultural economists, and most commercial farmers know this popular belief is deeply mistaken. For every bushel produced, modern science-based farming actually does far less damage to the environment, compared to traditional farm practices. Modern methods have sharply reduced the need for water, land, energy, and chemical use on farms, saving money for farmers and protecting nature at the same time.

For example, data from USDA indicate that for every bushel of corn produced in the U.S. since 1980, irrigation water use has fallen 46 percent, energy use 41 percent, and

¹⁹ <https://www.congress.gov/bill/117th-congress/senate-bill/1371>

²⁰ Chicago Council on Global Affairs, 2023. Prioritizing Agricultural Research in the 2023 Farm Bill, February. <https://globalaffairs.org/research/report/prioritizing-agricultural-research-2023-farm-bill>

²¹ Congressional Research Service, Agricultural Research: Background and Issues, R40819, November 2022.

greenhouse gas emissions 31 percent.²² Total fertilizer use in American farming peaked in absolute terms in 1981, and it has remained essentially flat since then even as total crop production grew 44 percent.²³ The total pounds of pesticide applied to American crops declined in absolute terms by 18 percent between 1980 and 2008, even as production was increasing. America's use of insecticides has now fallen more than 80 percent below the 1972 peak in absolute terms.²⁴

Modern farming continues to do environmental damage today, but this is primarily because of how much *more* we are producing (three times as much as in the 1940s), rather than today's science-intensive production methods. If we had tried to triple production using the traditional methods of yesterday, the environmental harm would be far greater. In fact, in many respects the damage back then was already greater than today: Think about the disastrous dust bowl on the Southern Plains in the 1930s.

Modern commercial farms in the United States have been moving toward something known as "precision agriculture," by making use of satellite-based global positioning systems (GPS), digital soil mapping, variable-rate water and chemical applications, unmanned aerial vehicle (UAV) imaging, artificial intelligence (AI), robotics, machine learning, and also big data. Along with the rest of the economy, farming is going digital; it is becoming information-intensive rather than resource-intensive, which is a good thing. To move more quickly down this nature-friendly path in the United States we should restore earlier public funding levels for agricultural R&D.

The Science Challenge in Low-Income Countries

America's investments in agricultural science can also pay off to increase food security in low-income countries. It was an American crop scientist, Norman Borlaug, who developed the improved wheat varieties that saved millions from famine in India in the 1960s. Borlaug's new seeds doubled India's wheat production in just five years, and he was awarded the 1970 Nobel Peace Prize. (Pamela Ronald follows Borlaug's footsteps, developing improved varieties of rice.)

More recently another American scientist, Jennifer Doudna at Berkeley, has opened an entirely new window for crop improvement by describing, with her colleagues, a rapid

²² Field to Market, 2016. *Environmental and Socioeconomic Indicators for Measuring Outcomes of On-Farm Production in the United States*, Table 1.6,

http://fieldtomarket.org/media/2016/12/Field-to-Market_2016-National-Indicators-Report.pdf

²³ USDA, 2019. "Fertilizer Use and Price," ERS,

<https://www.ers.usda.gov/data-products/fertilizer-use-and-price/summary-of-findings/>

²⁴ USDA, 2014. Fernandez-Cornejo, et al., "Pesticide Use Peaked in 1981, Then Trended Downward, Driven by Technological Innovations and Other Factors," *Amber Waves*, June.

and low-cost method for genome editing named CRISPR, a breakthrough that earned her the 2020 Nobel prize in chemistry. Doudna's work will allow us to alter the nutritional composition of crops to combat malnutrition, remove toxins from staple foods like cassava, increase yields to fight hunger, and reduce the need for chemical sprays by improving pest resistance.²⁵

It is significant that neither Borlaug nor Doudna was funded through the research title of the farm bill. Borlaug's work was supported by the Rockefeller Foundation, and Doudna's work on CRISPR was initially funded by the National Science Foundation, plus the Department of Energy. USDA, then, is far from alone in funding the research job.

When it comes to getting new agricultural science into the hands of farmers in low-income countries, an additional set of institutions and programs will need Congressional support. Rich country R&D breakthroughs do not automatically spill over to reach farmers in low-income countries, where different crops are grown under quite different social and environmental circumstances. Highly localized adaptations thus become an important part of the agricultural science challenge.

America's lead agency in meeting this challenge is the U.S. Agency for International Development (USAID), which manages an all-of-government \$1 billion Feed the Future Program. USAID also remains a major funder for the Consultative Group on International Agricultural Research (CGIAR), an international network that operates 15 research centers around the world, bringing new agricultural science into the national farming systems of low-income countries.²⁶ Other donor governments, plus the Bill & Melinda Gates Foundation, are important partners in these public research and assistance efforts.

What About the Private Sector?

Private companies can also play an important role in meeting agricultural science challenges. As noted earlier, the annual research investments made by America's private agricultural input industries now exceed our public investments. Yet there are limits to what private research can deliver by itself to impoverished small farmers in low-income countries.

²⁵ United Nations Food and Agriculture Organization (FAO), 2022. *Gene editing and agrifood systems*. Rome. p. v.

²⁶ <https://www.asti.cgiar.org/sites/default/files/pdf/Building-AKISs-USAID.pdf>
Strategies to Ensure Global Food Security

In the United States, because commercial farmers have purchasing power, private agricultural research investments will be rewarded when they add commercial value to the more basic research discoveries that come from not-for-profit public universities and research institutes. Congress sought to advance such synergies with non-governmental funders in the 2014 farm bill when it created a Foundation for Food and Agricultural Research (FFAR), a public-private partnership that leverages public research funds by matching every federal dollar with \$1.40 dollars in non-federal investments.²⁷

Yet in low-income countries the private sector frequently lacks an incentive to play a partnership role, because farmers there are often too poor to be good customers for the products these companies will want to sell. This is one reason private companies fund only 8.3 percent of agricultural research in less-developed countries, much less than the one third funded globally.²⁸ This is a small percentage of what is also a very small number, because governments in low-income countries spend very little public money on agricultural research.

In Sub-Saharan Africa, although more than half of all citizens depend on farming or herding livestock for some or all of their income, governments seldom devote more than five percent of their public budget to any kind of agricultural development, and only a tiny part of that goes to agricultural research. Moreover, the public funds going for research will primarily go to paying staff salaries rather than to research operations and program costs, so the public sector scientists may lack the lab and field resources needed to do productive work.²⁹

Private agricultural companies also hesitate to locate significant research efforts in low-income countries because of capricious government regulations, weak protection for intellectual property, and sometimes official corruption. When the International Finance Corporation rated the “least business-friendly countries” around the world, it found that thirteen out of the bottom twenty are in Africa.³⁰ This is not a reason to turn away from Africa’s agricultural research needs, but it does help to explain why private companies have not been taking the lead.

²⁷ <https://foundationfar.org>

²⁸ <https://www.asti.cgiar.org/sites/default/files/pdf/Building-AKISs-USAID.pdf>

²⁹ Stads, Gert-Jan. 2016. Investment in agricultural research and development: An account of two-speed growth, underinvestment, and volatility. In *Agricultural research in Africa: Investing in future harvests*. Lynam, John; Beintema, Nienke M.; Roseboom, Johannes; and Badiane, Ousmane (Eds.). Chapter 4. Pp. 85-108. Washington, D.C.: International Food Policy Research Institute (IFPRI). http://dx.doi.org/10.2499/9780896292123_04

³⁰ <http://www.doingbusiness.org/rankings>

The best way for Congress to address unmet agricultural research needs in the low-income countries of Africa and Asia will be to provide continued support for USAID's Feed the Future (FTF) Program. This program was created in 2010, then codified through Congressional action in 2016, and then reauthorized for a second time in 2022 with a strong bipartisan 331-95 vote in the House. The \$1 billion cost of FTF is relatively small compared to USAID's annual spending for humanitarian assistance, which totals roughly 15 times as much.³¹ Support for increased farm productivity through FTF will reduce the future need for direct food aid in any case, and it is cheaper. Compared to providing direct food aid, agricultural production assistance through FTF can feed a family in the developing world at only one sixth the cost.³²

FTF is currently supporting wheat farmers in South Asia who struggle against climate challenges, working through Kansas State University with research sites in India, Pakistan, and Bangladesh. FTF is supporting researchers at Kenyatta University and Addis Ababa University who are using CRISPR to develop improved varieties of sorghum, and in Ghana FTF is investing in research to develop small-scale solar-powered irrigation systems to help small farmers.³³ And much more. FTF works in twenty different countries overall.

The United States has traditionally led the world in using science to develop productive agricultural systems. We should not want to give up that honor to scientists in China. By 2018, China already had nearly as many CRISPR patent applications and published scientific papers on CRISPR as the United States, and some of the results have been tantalizing. Chinese scientists have learned how to silence a gene that restrains kernel production in corn, possibly resulting in an added 10 percent increase in yield.³⁴ More recently we have learned about Chinese progress in developing labor-saving, soil-protecting perennial rice plants.³⁵ These are exciting breakthroughs, but I wish they were being made by scientists in the United States. Restoring public funding to our own scientists can help make that possible

³¹<https://www.usaid.gov/sites/default/files/2022-10/FY-2023-Congressional-Budget-Justification-Appendix-2-final-5-9-2022.pdf>

³² USAID, 2022. Administrator Samantha Power at the World Food Prize Foundation's Annual Norman E. Borlaug International Dialogue. Des Moines, Iowa, October 19. <https://www.usaid.gov/news-information/speeches/oct-19-2022-administrator-power-world-food-prize-foundations-annual-international-dialogue>

³³ USAID, 2022. Administrator Samantha Power at the World Food Prize Foundation's Annual Norman E. Borlaug International Dialogue. Des Moines, Iowa, October 19. <https://www.usaid.gov/news-information/speeches/oct-19-2022-administrator-power-world-food-prize-foundations-annual-international-dialogue>

³⁴ Kristin Houser, "7 ways CRISPR is shaping the future of food," Genetic Literacy Project, November 14, 2022.

³⁵ <https://www.science.org/content/article/perennial-rice-saves-time-and-money-comes-risks>



EXECUTIVE SUMMARY

True Cost of Food Measuring What Matters to Transform the U.S. Food System



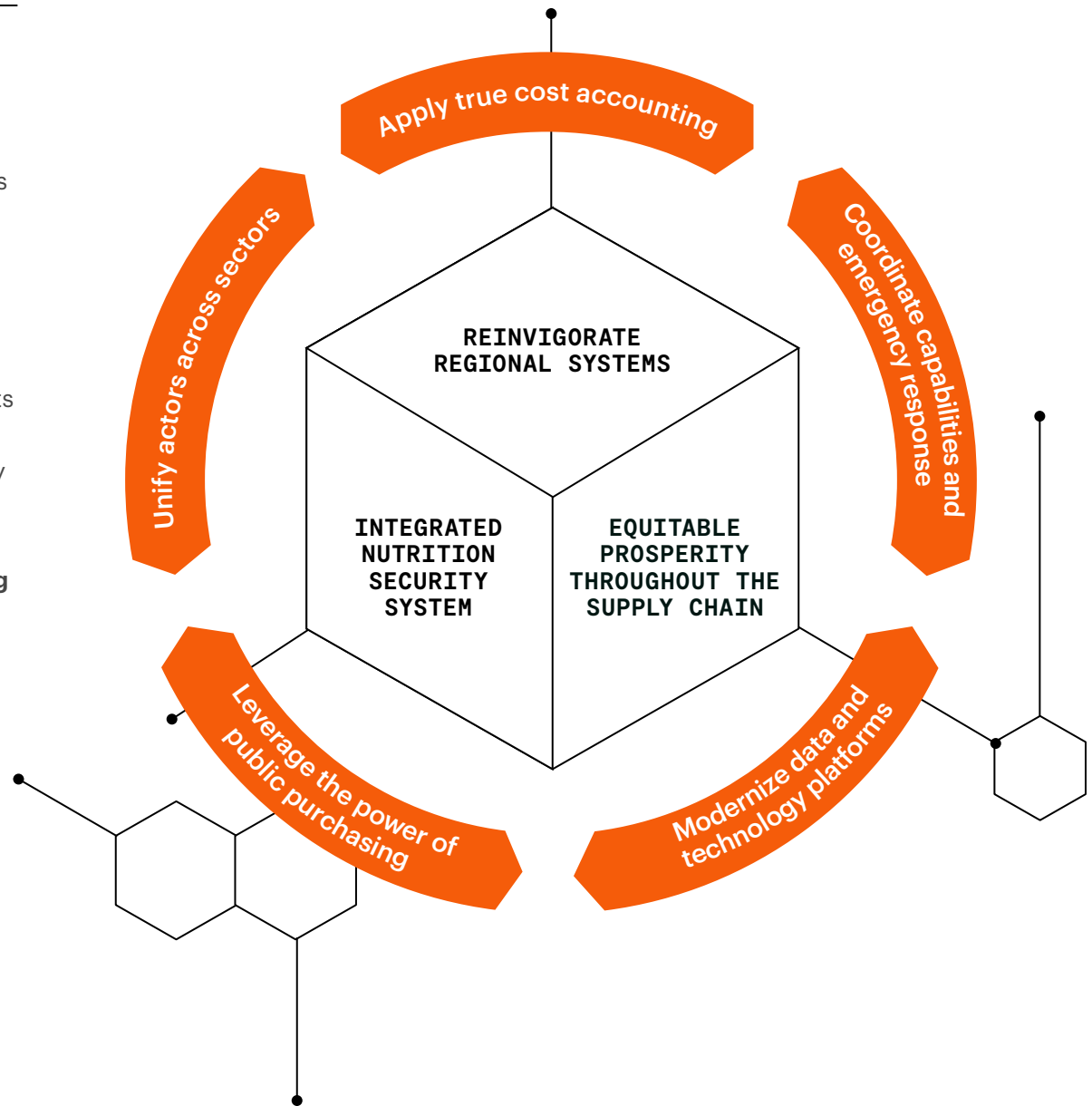
JULY 2021

Answering the Call to Reset the Table

Over the past year, the Covid-19 pandemic exposed significant weaknesses in the U.S. food system, and America faced a food and nutrition crisis unlike any this country has seen for generations. As we emerge from this crisis, there is a unique opportunity to transform the U.S. food system.

The Rockefeller Foundation's previous report [Reset the Table: Meeting the Moment to Transform the U.S. Food System](#) (published in 2020) identified three required shifts to make the U.S. food system more equitable, resilient, and nourishing: moving to an integrated nutrition security system; reinvigorating regional and local food systems, and ensuring equitable prosperity throughout the supply chain. **The report identified five necessary cross-cutting capabilities to make these shifts, including the use of true cost accounting.**

Recommendations from Reset the Table (2020) on the capabilities and shifts needed to transform the U.S. food system



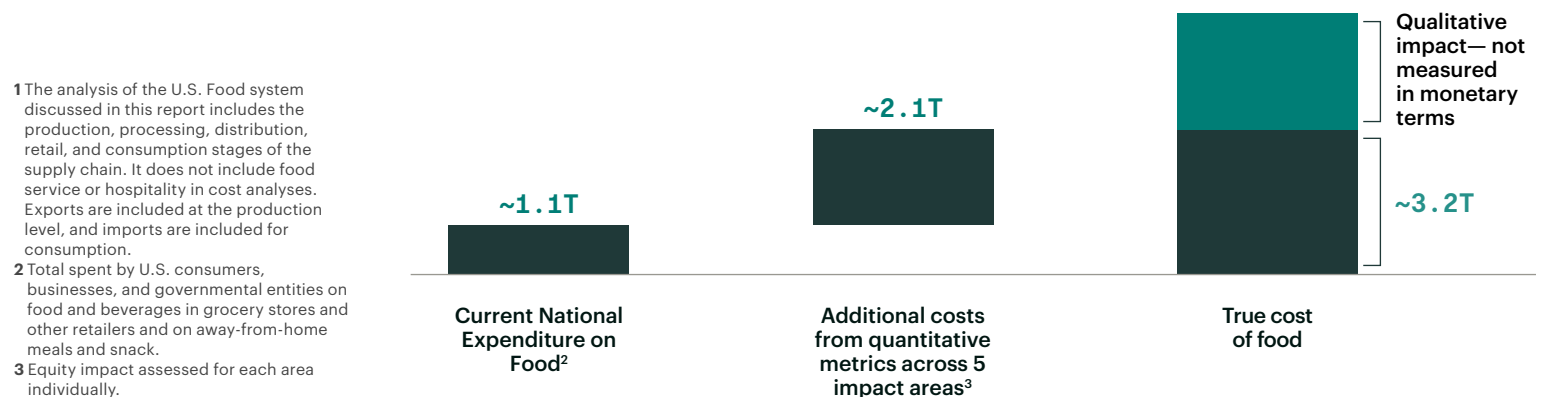
Understanding the true cost of the food we consume is a first and necessary step towards remaking the incentive structure that drives our food system today and, ultimately, transforming it. Applying true cost accounting ensures that all food system stakeholders understand the full benefits and costs of the current system. It allows for more informed decision-making and helps to ensure that the public and private sectors are getting the maximum value from limited resources. When applied across the food system, true cost accounting helps identify and address inequities in our food system.

This report, *True Cost of Food: Measuring What Matters to Transform the U.S. Food System*, draws on the insights from dozens of experts and is one of the first true cost analyses of the U.S. food system.

The True Cost of Food is Three Times Higher Than Originally Thought

As a country, we spend a total of \$1.1 trillion a year on food. When we applied a true cost accounting framework, the current cost of our food system grew to more than \$3 trillion per year. When we consider the impacts and food-related costs on our health care system, environment, and biodiversity, it is clear that communities of color are disproportionately affected.

ESTIMATED TRUE COST OF FOOD IN THE U.S., ANNUAL (T USD)



Of the impact areas we assessed in our study, the costs related to human health were by far the most significant driver of unaccounted-for costs, at roughly \$1.1 trillion per year. That figure alone nearly doubles the cost of our food system—our national ‘bill’ for the diet-related disease is equal to all the money we currently pay for the food itself.

The unaccounted costs of the food system on the environment and biodiversity add up to almost \$900 billion per year. These costs are mainly attributable to two areas: greenhouse gas (GHG) emissions and biodiversity costs. GHG emissions directly contribute approximately \$400 billion in additional costs of the food system, primarily due to GHGs from food production and plastic.

There is considerable evidence that food workers and producers—who are overwhelmingly from marginalized communities, and in particular from communities of color—bear the burden of these impacts. **We estimate that the unaccounted livelihood costs are approximately \$100 billion of the true cost of food.** This includes costs of child labor, unlivable wages, a lack of standard employment benefits (such as healthcare) for producers and workers across the value chain, and occupational health and safety costs.

Applying True Cost Methodology Leads to Better Policies and Practices

These findings point to an enormous opportunity for a collective reimagining of our food system. We need holistic and transformational change to build a food system that provides healthy and affordable food for all consumers. **We also need a system that delivers fair, livable wages, safe working conditions for workers and producers, viable farming options for rural communities, and sustainable use of our natural resources.**

Without true cost accounting, decisions made by public and private entities often prioritize short-term, direct costs while failing to consider the long-term and indirect costs that might have led to a different decision or justify a long-term investment. Applying a true cost accounting framework to the food system and individual interventions and investments helps to build the case for critical changes and better inform solution design.

For example, the recognition that we are incurring \$1.1 trillion per year in food-related human health costs supports the recommendation to expand Food is Medicine programs that provide nutrition incentives as a part of healthcare delivery. This data on the true cost of food strengthens the economic case to invest in equitable access to Produce Prescription programs, medically tailored meals, and other programs that enable health

care providers to connect patients with healthy food. Even if only a portion of the \$1.1 trillion in human health costs could be prevented, it would likely be well worth the upfront investment needed to scale these interventions. Successful application of true cost methodology can also inform the best ways to ensure nutrition security for all, including an improved, evidence-based assessment of return on investment for critical public nutrition programs such as school meals, SNAP and WIC.

Seeing how marginalized communities and in particular communities of color bear disproportionate costs across issue areas provides support for expanding programs specifically designed to address these disparities. We should direct the purchasing power of large institutions along a values-based (equitable, ethical, healthy, sustainable) supply chain by incentivizing, requiring, or otherwise enabling institutions' food procurement to prioritize a diversity of producers and suppliers that embody these values. In addition, we should explore investments in economic development; labor policy changes; wage structures that reflect the value contributed by workers; and infrastructure funding to support local supply chains.

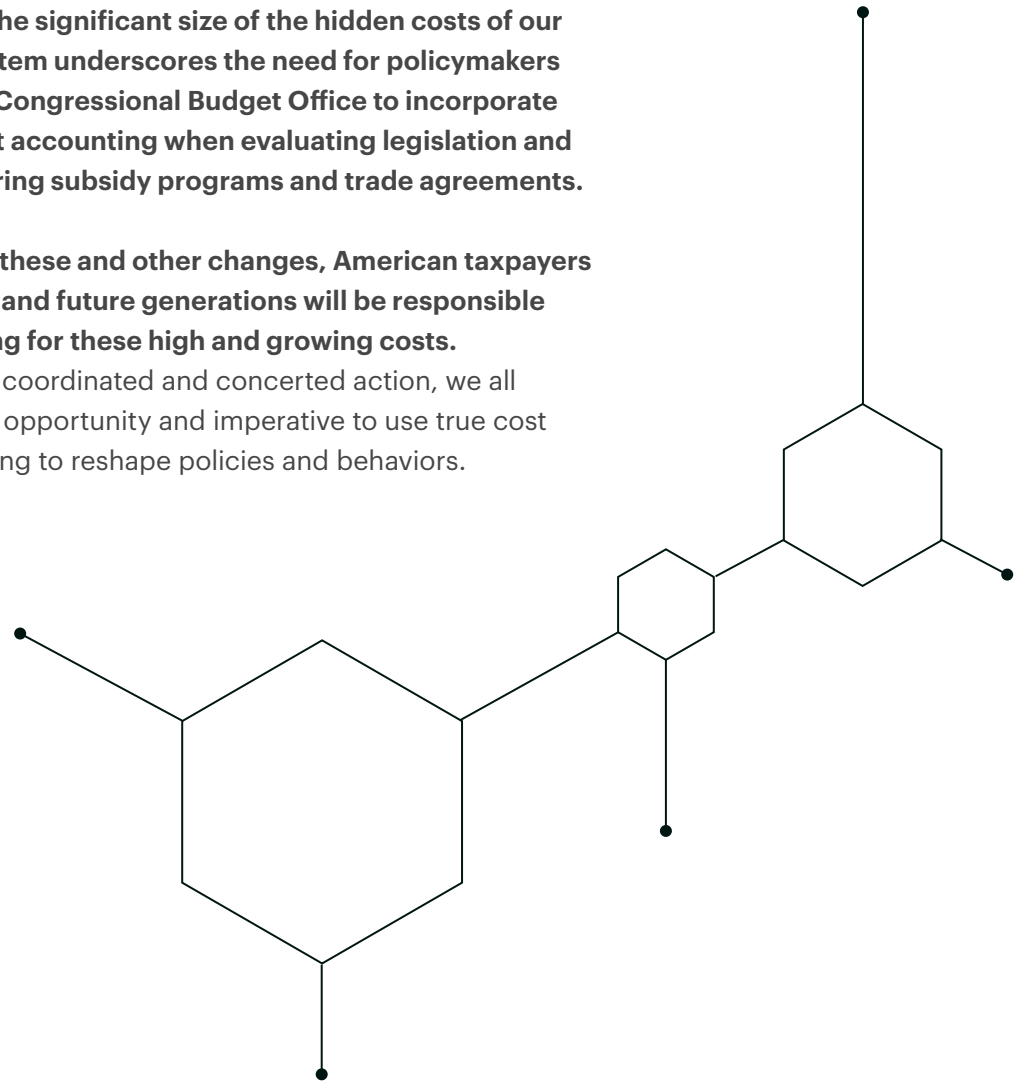
This analysis can also inform how private sector companies and investors incorporate true cost accounting practices into their own long-term strategy and reporting. Such changes can support environmental, social, and governance (ESG) goals and help demonstrate to shareholders and stakeholders a company's sustainable business growth. This could include new financial markets related to natural capital, including carbon, water, soil nitrogen, and biodiversity,

and deeper engagement from companies and investors on human health. It might also encourage a deeper investment in Food is Medicine programs by healthcare providers and the implementation of value-based purchasing and contracting.

Finally, the significant size of the hidden costs of our food system underscores the need for policymakers and the Congressional Budget Office to incorporate true cost accounting when evaluating legislation and considering subsidy programs and trade agreements.

Without these and other changes, American taxpayers of today and future generations will be responsible for paying for these high and growing costs.

Through coordinated and concerted action, we all have the opportunity and imperative to use true cost accounting to reshape policies and behaviors.



[Read the full report](#)
rockefellerfoundation.org

Policy Action Memorandum for Members of Congress³⁶

Recommendations to Address Global Food Crisis:

- The U.S. is the largest donor of food aid with generous emergency food assistance to low-income countries. These efforts should be complemented with programs preventing and treating malnutrition globally to end preventable child and maternal deaths with nutritional supplementation (e.g. providing four lifesaving elements for women and children: (1) ready-to-use-therapeutic food (RUTF), like Plumpy’Nut; (2) prenatal vitamins; (3) vitamin A supplements; (4) breastfeeding support and education for mothers).
- The U.S. is the only country that ships food aid from the U.S. to the destination. The government should consider providing only cash like other aid donors to cut transportation costs or double the amount of food aid for the same appropriation.
- The U.S. should lead the conversations with health providers to treat “food as medicine” and allow health practitioners to prescribe healthy diets to address malnutrition. The National Institutes of Health should devote more resources to nutritional research.
- The government should boost national literacy on food and healthy eating by incorporating more content on nutrition in the public education system.
- Publicly supported agricultural research programs in the U.S. focus more on the production of cereal grains and oilseeds than other commodities. This has reduced the cost of calorie-dense foods relative to the price of fruits and vegetables, discouraging consumers from eating more nutrient-dense foods. The upcoming **Farm Bill should:**
 - increase research on “specialty crops;”
 - revisit SNAP rules and reconsider allowing sugary beverages and calorie-dense highly processed foods for purchase, which have limited nutritional value;
 - fund the McGovern-Dole Food for Education Program and the Bill Emerson Humanitarian Trust at least at their present levels;
 - reauthorize the Foundation for Food and Agricultural Research at twice current levels, with appropriations for agricultural research growing five percent per year from present levels.

³⁶ Note: This policy action memo is compiled for Congressional participants and depicts policy ideas that emerged during the conference sessions in Bellagio. We are a neutral convener. We are not advocating any of these policies; we are merely cataloging the ideas that came forth.

- The U.S. government should support **more research on**:
 - increasing crop resilience to more frequent occurrences of extreme climatic conditions;
 - how climate change reshapes agricultural productivity and educate farmers to successfully adapt to an emerging landscape;
 - generating new green technology to minimize greenhouse gas emissions and ensure global food security. If agriculture and the food system contribute 30 percent of greenhouse gas emissions, they should receive 30 percent of new climate change monies for research.

- **USAID** should:
 - rebuild its commitment to agricultural development in low-income countries, including an African soils initiative to rebuild its soil organic matter and nutrient levels to improve crop production and increase carbon sequestration;
 - encourage governments of low-income countries to invest more of their resources in agricultural research and rural public goods like roads, education, and health care;
 - bring agricultural scientists from low-income countries to U.S. universities for training;
 - double its support to the Consultative Group for International Agricultural Research.

- The U.S. government should encourage and incentivize the **private sector** to:
 - create non-farm jobs in rural areas to reduce rural poverty in low-income countries;
 - invest in building a sustainable food system, including refrigerated transport and storage to deliver fresh produce, meat, fish, and dairy products to urban markets in developing communities;
 - invest in low-income countries by providing local currency guarantees. The U.S. International Development Finance Corporation (DFC) should be an important contributor to this;
 - apply its research resources to solve urgent agricultural problems in low-income countries without the need to receive royalties for the resulting technologies.

Congressional Reflections:

- Global food security is a national security issue for the United States. Poverty begets hunger, which begets migration in search of a better life through illegal immigration into the United States. The U.S. needs a more proactive policy in low-income countries to reduce poverty and illegal migration rates.
- The U.S. should exercise global leadership to keep food security high on the agenda of the private sector, foreign aid programs, NGOs, international development banks, and on the budgetary priorities of low-income countries.
- The United States Government should assign an official who will cut across government agencies to ensure and advocate global food security.
- The U.S. should make a billion-dollar commitment annually to improving food security in low-income countries for at least a decade. This will empower those countries to gradually graduate from U.S. support. There should be greater balance between emergency feeding and developing the long-term food production capacity.
- It is the time to shift the priority from AIDS to global food security. To build a sustainable food system in Sub-Saharan Africa, the U.S. should adopt the similar approach to PEPFAR, which will mean leveraging the private sector's participation in innovation, technology, marketing, and distribution.
- The U.S. Congress should maintain support and funding for Feed the Future through appropriations. Congress should also modernize and update Feed the Future to help predict and model what countries need more targeted assistance. Feed the Future may also benefit from a separate fund and organizational structure outside of USAID to work across agencies to ensure global food security.
- The U.S. should host a U.S.-Africa Leadership Summit at least every second or third year, not once a decade. The U.S. should project at least as great a diplomatic commitment to the region as China does.

