



Climate Change and Food Security

A Test of U.S. Leadership in a Fragile World

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OCTOBER 2019

THE ISSUE

Climate change poses a considerable threat to global food security, with potentially existential economic, political, and social outcomes for humanity. As climate impacts worsen and further stress an already hungry world, the United States should claim the mantle of global leadership in responding to the impacts of climate change, double down on domestic efforts to promote climate-smart agriculture, elevate the issue of climate change and food insecurity in national security circles, and leverage the reorganization of the U.S. Agency for International Development (USAID) to further mainstream climate resilience into U.S. global food security programs.

As people around the world increasingly feel the impacts of climate change, the collective call for action grows louder and louder. The effects of climate change on food production—often neglected in favor of stories on melting glaciers, tropical storms, and sea level rise—are receiving more and more mainstream attention. This brief seeks to summarize the relationship between climate change and food insecurity, highlight salient trends and controversies, and comment on U.S. government global policies and programs that tackle this important issue.

THE STATE OF GLOBAL FOOD SECURITY

The impacts of climate change threaten a complex global food system that is already struggling to meet the needs of a growing and changing population. After great progress over the last decade, the number of chronically hungry people around the world has grown in each of the last three years. Today, 821 million people—one in nine—are undernourished. These people experience a shortage of food each day, while over twice that number face moderate

food insecurity and frequently compromise on the quality or quantity of food they consume. At the same time, over 2 billion people around the world are overweight or obese, and over 1 billion suffer from micronutrient deficiency, sometimes referred to as “hidden hunger.” To amend a famous line from author Raj Patel, the world today is “stuff, starved, and hollowed out.”¹

The number of hungry and malnourished people worldwide has grown in tandem with a rise in human conflict and forced displacement.² Slow economic recovery from the 2008 global financial crisis (and food price spikes) and the increasing frequency and magnitude of climate-related extreme events have helped reverse years of progress fighting global hunger.^{3,4} These combined, interrelated factors have placed unprecedented stress on humanitarian organizations: humanitarian appeals have ballooned to record levels.⁵ Unsurprisingly, the places most impacted by food insecurity—especially Africa and South Asia—are also those suffering from the most pervasive forms of poverty and environmental vulnerability.

CLIMATE CHANGE AND AGRICULTURE

Despite the millions of acres of industrial cropland, satellite-guided tractors, and shining supermarkets in places like the United States, a large percentage of food worldwide is still produced on relatively small parcels of land by smallholder, subsistence farmers who rely solely on rainfall to water their crops and animals. These practices mean that long-term changes in climate intimately impact food production—perhaps more than any other sector of the global economy. Since the mid-1800s and the Industrial Revolution, surface air temperatures over Earth’s land area have warmed by an average of 1.5°C.⁶ Much of that warming has occurred since 1975 as concentrations of carbon dioxide and other greenhouse gases (GHG) in the atmosphere steadily accumulate.⁷

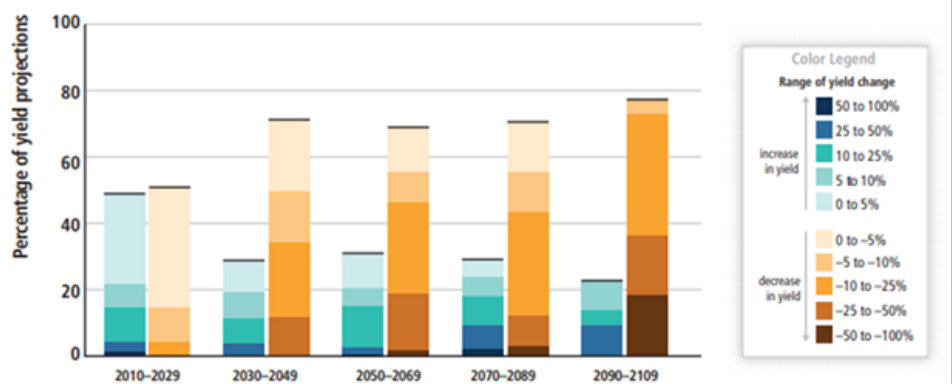
In places like sub-Saharan Africa, unlike highly industrialized economies, agriculture represents a disproportionately large percentage of countries’ gross domestic product (GDP) and employs up to 80 percent of the rural population. Farming in such places often occurs on heavily degraded lands and lacks high-quality inputs like seed and fertilizer and access to agricultural markets. It is no surprise, then, that subsistence farmers represent over half of the world’s hungry people (of whom half, in turn, are women).⁸ According to the United Nation’s World Food Programme (WFP), at least 80 percent of the world’s hungry people live in places prone to natural disasters and environmental degradation, including many of the world’s poorest places.⁹

Climate change impacts on agriculture vary considerably by geography. Climate change has already been linked, for example, to changing patterns of agricultural pests and diseases, saltwater intrusion from sea level rise, and even the decline of nutritional quality in plants. In fact, recent research has shown that with highly elevated concentrations of atmospheric carbon dioxide (CO₂), iron and zinc content in plants could fall by as much as 17 percent, accompanied by an increase in starches and sugar production in plants. This shift in nutritional quality could cause an additional 175 million people to experience zinc deficiency and 122 million to experience protein deficiency, according to researchers.¹⁰ Undernutrition

already costs the global economy \$3.5 trillion in lost opportunity and human capital.¹¹

Climate change most directly impacts food production through crop yield changes, typically from temperature increases and rainfall variability. A general rule of thumb in the equatorial tropics is that every 1°C rise in mean temperature is associated with a 10 percent drop in crop yields. Temperature spikes during critical phases of a plant’s growth can lead to outright crop failure. Although impacts will vary considerably by crop and production system, some countries in sub-Saharan Africa and other low-latitude places will likely see yields from rain-fed maize, wheat, and rice fall considerably in the coming decades.¹² While reports often reference a 1.5°C to 2°C “safe” level of warming that would avoid the most devastating impacts from climate change, agricultural systems—especially where crops are already grown dangerously close to their biophysical limits—are immediately vulnerable to any additional warming.

Crop Yields Will Likely Plummet Due to Climate Change



Source: Andrew J. Challinor et al., *Climate Change 2014: Impacts, Adaptation, and Vulnerability* (New York: IPCC, 2014), https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap7_FINAL.pdf.

By some estimates, between 12 and 39 percent of the world’s land surface will develop novel climates by 2100 as a result of climate change.¹³ Today’s agriculture remains land and resource intensive. Agricultural production—both crop and pasture—occupies more than 40 percent of total land area and accounts for at least 70 percent of all freshwater withdrawals globally.¹⁴ Climate change, land degradation, and biodiversity are linked in a complex feedback loop—a vicious cycle.¹⁵ These impacts are already being felt and chronicled today. A recent report by the Intergovernmental Panel for Climate Control (IPCC) suggests that soil is eroding 10 to 100 times faster than it is being formed, a process accelerated by climate change impacts like drought and high-intensity rainfall.¹⁶ Meanwhile, unprecedented biodiversity loss—especially among pollinators, bacteria, and fungi in soils, and

natural predators that control pests—is being fueled in part by climate impacts, according to the Food and Agriculture Organization (FAO) of the United Nations.¹⁷

Ultimately, climate change will most severely impact those places least able to cope. Climate change will threaten years of development progress and thrust many vulnerable populations into poverty—adding as many as 122 million more people by 2030.¹⁸ Increasing evidence shows that climate change may also slow the decrease in inequality between countries, reducing GDP among the world's poorest populations by up to 30 percent.¹⁹ As a consequence, climate change is fraught with questions of global justice and inequality, especially as industrialized countries generated an overwhelming majority of historical CO₂ emissions.

THE THREAT FROM DROUGHT

Of all the impacts from climate change on agriculture and food security, drought may be the most harmful for smallholder farmers and other vulnerable populations. Given improved early warning and humanitarian responses, large-scale deaths from famine are increasingly a thing of the past, but drought in the Horn of Africa, Southern Africa, and Central America has been long associated with famine. In these places where rain-fed agriculture is prevalent, over 80 percent of a drought's economic impact is felt in the agricultural sector.^{20,21}

Multi-year drought is especially devastating for subsistence farming families. Each year without a good harvest pushes the hunger season further ahead and diminishes seed stock for next year's planting.²² Long-term drought also destroys precious topsoil, allowing it to blow away in high winds or wash away during heavy rains. From a food security perspective, drought in some parts of the world is increasingly synonymous with El Niño. A climate phenomenon resulting from irregular Pacific Ocean temperatures near the equator off the coast of South America, El Niño is triggered by a change in trade winds that would typically push colder waters westward. Research indicates that a general warming trend on the earth could increase the frequency of so-called "Super El Niño" events.²³ Consistent with this trend, the 2015/16 El Niño event was among the strongest on record, bringing record drought to Central America's Dry Corridor.

Droughts and other climate-related extreme events are becoming more frequent because of the impacts of climate change, some evidence shows. In fact, they have more than doubled in frequency over the last 25 years, as researchers noted in the 2018 edition of *The State of Food Security and*

Addressing food system impacts from climate change is not merely an environmental challenge, it is a human development imperative.

Nutrition in the World. In the early 1990s, approximately 100 of these events were recorded each year; today, that number is 213.²⁴ Moreover, in a relatively new area of investigation, researchers have linked the impacts of climate change to so-called "multiple breadbasket failure," or the potential for widespread weather-related losses to major food-producing regions simultaneously.

In summary, addressing food system impacts from climate change is not merely an environmental challenge, it is a human development imperative. By some estimates, global food production must increase by as much as 70 percent by 2050 to meet the needs of a growing population.²⁵ This is both a challenge and an opportunity: in developing countries, GDP growth in the agricultural sector is more than twice as effective at reducing poverty than growth in competing sectors, but climate change will make it more difficult to meet production needs and to secure poverty reduction targets through agriculture.²⁶

AGRICULTURAL GREENHOUSE GAS EMISSIONS

Although the agricultural sector will suffer from the impacts of climate change—especially in developing countries and for subsistence farmers—agriculture is also increasingly being recognized for its underlying contributions to GHG emissions. In fact, by some estimates, agriculture and food systems account for one-quarter of global GHG emissions. Not all greenhouse gases are created equal. Some, like methane (CH₄), remain in the atmosphere for a shorter period but have a much stronger greenhouse gas effect: CH₄ has almost 30 times the effect of CO₂. Agriculture is the single largest contributor to non-CO₂ GHGs and accounts for half of all such global emissions.

Livestock production alone is estimated to emit almost 15 percent of all global GHGs, mainly in methane from livestock's digestive systems, but also from production of animal feed and forage, transportation, and processing.²⁷ Livestock belong to a unique class of mammals called ruminants that, unlike ourselves, can acquire nutrients from grasses by fermenting them in a specialized stomach before digestion. A by-product of ruminant digestion is methane. With 3 to 4 billion head of ruminant livestock in the world,

this enteric fermentation contributes greatly to agriculture's GHG footprint, one that is likely to increase given meat consumption trends across emerging economies.

The second largest category of agricultural GHG emissions come from our soils. Soil represents a significant stockpile of carbon (and non-CO₂ GHGs), holding more than three times the amount currently in the atmosphere.²⁸ Complex interactions of microorganisms, constantly at work in agricultural soils, are disturbed by tillage, deep ploughing, and the overuse of synthetic fertilizers. A by-product of such disruptions is GHG emissions. It is estimated that 75 billion tons of topsoil on arable lands are lost each year, at a cost of \$400 billion to the global economy.²⁹ Not only does soil organic matter help to improve moisture retention, reduce fertilizer runoff, and limit erosion, it may also be agriculture's greatest opportunity for carbon capture.

Not all of the food system's contribution to climate change comes from on-farm production. Increasingly, GHG emissions from food loss and waste are capturing headlines. Globally, \$1 trillion in food is lost or wasted each year. In industrialized nations like the United States, this often occurs on the demand side: unpurchased or uneaten food ends up in landfills and produces methane as it degrades.³⁰ In developing countries, up to 40 percent of harvests are lost before making it to market because of inadequate storage or transport infrastructure.³¹ All told, if it were a country, food loss and waste would be the third largest emitter in the world behind China and the United States. The agricultural sector—which combines deforestation from agricultural expansion (agriculture is the leading global driver of deforestation) with emissions from the processing, transportation, and marketing of food products—contributes in multiple ways to the underlying problem of climate change.

CLIMATE CHANGE, FOOD INSECURITY, MIGRATION, AND INSTABILITY

The 2014 *Quadrennial Defense Review* (today's *National Defense Strategy*) marked a turning point in how the United States thinks about the issue of climate change. For the first time, the Department of Defense cited climate change as a "threat multiplier" and noted that "the impacts of climate change may increase the frequency, scale, and complexity of future missions."^{32,33} This position results, in part, from the steady advancement in academic research that links climate change to global instability. As the evidence base grows, it becomes increasingly clear: the link between climate change and global instability often runs through our food systems.

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That conflict is on the rise around the world is unmistakable. Today, more countries experience violent conflict than at any time in nearly three decades.³⁴ If current trends persist, more than half of the world's poor will be living in countries affected by high levels of violence in next decade.³⁵ This trend has led to the displacement of over 70 million people from their homes, with many crossing borders to seek refuge—numbers not seen since World War II, if ever before.³⁶ Displacement can produce hunger and, in a vicious feedback loop, hunger can produce displacement. Over 60 percent of the hungry people on the planet live in conflict-affected countries and three-quarters of stunted children live in these same places.³⁷

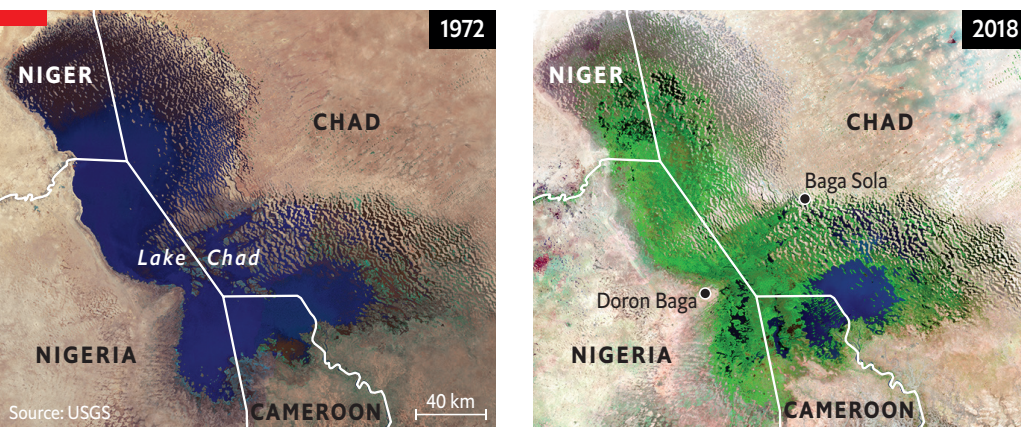
SAHEL

The relationship between climate change, food insecurity, and instability frequently centers on control of critical natural resources like land and water, further mediated by factors like poverty, demographics, and history of violent disputes. In fact, the United Nations Environment Programme reports that almost half of all internal conflicts over the past 70 years resulted from resource competition.³⁸ This phenomenon is playing out today in the African Sahel, a strip of arid land that sits below the Sahara Desert and stretches across the continent from Senegal to Djibouti. The region is home to almost 100 million people and hosts one of the fastest population growth rates in the world, with the number of people in the region expected to double in the next two decades.³⁹ Many families in the Sahel rely on subsistence agriculture and pastoralism for their livelihoods and depend heavily on natural resources like land and water.

In a region already synonymous with drought, the region is increasingly considered by experts as a climate change hotspot, with unpredictable weather patterns becoming the new norm. The region is expected to warm at a rate 1.5 times faster than the global average, with temperatures increasing by 3°C to 5°C by 2050.⁴⁰ The region suffers from desertification from the Sahara Desert: the desert expanded by almost 20 percent over the last half century and creeps south by more than a mile each year.⁴¹ In one of the most striking examples of climate impacts and environmental degradation, Lake Chad, a critical water resource for fishers, pastoralists, and farmers, has lost 90 percent of its volume

since the 1960s.⁴² Across the Sahel, water availability per capita has plummeted in recent decades. This pressure on both land and water have caused widespread conflict between herders and sedentary agricultural communities. The Sahel is also home to a growing number of extremist organizations, including Boko Haram, al-Qaeda, and Al Shabab. Population growth, pervasive poverty, and environmental degradation have fueled these groups' ability to recruit for their causes, exploiting desperation and benefiting from limited state security presence in this expansive, sparsely populated region.⁴³ Former U.S. Africa Command (AFRICOM) commander General Waldhauser communicated this complexity to the Senate Armed Services Committee in early 2019: "Very few, if any, of Africa's challenges can be resolved using only military force. Consequently, U.S. Africa Command emphasizes military support to diplomacy and development efforts."⁴⁴

Major Water Sources Like Lake Chad Are Disappearing



Source: "How climate change can fuel wars," Economist, May 23, 2019, <https://www.economist.com/international/2019/05/23/how-climate-change-can-fuel-wars>.

THE DRY CORRIDOR AND THE NORTHERN TRIANGLE

The complicated relationship between climate change, food insecurity, and conflict is also often further filtered through the lens of migration. In sub-Saharan Africa, South Asia, and Latin America alone, over 140 million people may be forced to migrate internally from the impacts of climate change by the year 2050, according to World Bank estimates.⁴⁵ This migration is often the by-product of food insecurity. Through research with refugees in Afghanistan, Bangladesh, Iraq, Nigeria, Sudan, and Syria, for example, WFP estimates that, in those contexts, a 1 percent rise in food insecurity is associated with a 2 percent increase in migration.⁴⁶ Among those surveyed, most migrated internally three to five times before making the decision to leave their country because of overwhelming security concerns or an inability to meet

basic needs.

This phenomenon—the relationship between climate change, food insecurity, conflict, and migration—is on clear display today in Central America. The Dry Corridor of Central America (a geographical area of tropical dry forest that runs from southern Mexico to Panama) has experienced five consecutive years of erratic weather patterns, from prolonged drought to excessive rainfall, with dire consequences for families farming maize, bean, and coffee, in particular. Most farmers in the Dry Corridor—representing a large portion of the region's labor force—are subsistence producers, growing their food on steep hillsides and in poor soil. Intense drought, driven by one of the most powerful El Niño events on record, saw river levels in the corridor fall 20 to 60 percent below normal and crop losses between 50 and 90 percent in 2015 and 2016.⁴⁷

The Northern Triangle region of Central America (Guatemala, Honduras, and El Salvador) is home to some of the Western Hemisphere's poorest populations. Irregular migration to the United States from the region has increased because of erratic weather, El Niño impacts, and associated productivity losses and crop failures.^{48,49} In one study, almost half of the interviewed families with a recently emigrated family member were experiencing food insecurity—levels of food insecurity previously unseen in the region.⁴¹ On average, 250,000 people leave the Northern Triangle each year—many bound for

the United States—a figure that is expected to more than double in 2019.⁵⁰ In these countries, erratic weather events destroy crops and livelihoods and force families into a host of negative coping strategies, like selling farm equipment and livestock and eventually migrating.

Ultimately, food security is almost never the sole driver of instability or conflict. The conditions for conflict can be met when food insecurity joins certain individual motivations (e.g., existing grievances or underlying poverty), as researchers note in one review of over 50 peer-reviewed scientific journal articles on the link between food insecurity and instability.⁵¹ They categorize drivers of food-related instability into three interrelated groups that include resource competition, market failure, and climate-related extreme events, and note that 30

percent of the analyzed studies identify climate change as the principle driver of food-related instability. This trend is unlikely to fade. Research from the International Fund for Agricultural Development shows that countries with the largest proportions of youth populations also tend to be countries that depend most heavily on agriculture.⁵² Although the relationship between climate change and migration—or climate change and conflict—can be challenging to prove empirically, anecdotally they appear inextricably linked.

RETHINKING FOOD SYSTEMS IN THE FACE OF CLIMATE CHANGE

The link between climate change and increased food insecurity is not inevitable—nor are the outsized GHG emissions stemming from the global food system. As our understanding of the link between climate change and food insecurity improves, so too does our knowledge of how food systems can be part of the climate change solution. The consensus among scientists and policymakers today is that if we are to meet the 2030 Sustainable Development Goal of zero hunger (SDG 2), we must find ways to sustainably increase food production while significantly reducing the carbon footprint of our food system. Increasingly, we have evolved from a long period of identifying problems to offering solutions and are transitioning from theory to practice in the agricultural climate change space.

The politics of solution offering has, for many years, been caught up in debates over climate justice and “polluter pays” principles: the idea that those most responsible for historical emissions—mainly, industrialized countries—should be most responsible for emissions reductions. Agriculture represents a disproportionately large portion of most developing countries’ economies. Asking millions of subsistence farmers to consider the emissions produced through their agricultural practices has been politically fraught. In fact, global climate negotiations have largely avoided the question of agricultural mitigation, driven by a strong coalition of developing countries that argue that actions in their countries’ agricultural sectors should be limited to adaptation.

This reasoning has changed in recent years with the emergence of climate-smart agriculture (CSA): agricultural interventions and technologies designed to simultaneously adapt systems to change, mitigate GHG emission, and increase production. More than 1,700 unique CSA interventions across more than 30 developing countries—including cover cropping, reduced or zero-till agriculture, integrated crop-livestock systems, agroforestry and

silviculture, conservation of plant genetic material and crop wild relatives, and water management strategies like alternate wet and dry rice irrigation—show that farmers around the world are increasingly adopting beneficial CSA practices, especially when these practices yield gains in productivity and income.⁵³ In 2014, at the United Nations Climate Summit, the United States—alongside other donors, multilateral organizations like the FAO and the CGIAR research program on Climate Change, Agriculture, and Food Security, and private sector companies—launched the Global Alliance for Climate Smart Agriculture to help promote CSA and sustain momentum around the concept.⁵⁴

Food security solutions to the problem of climate change extend beyond on-farm actions. Project Drawdown, one of the first comprehensive global efforts to catalogue solutions to fight climate change and their impact on GHG emissions, cites three agriculture-related actions in its top 10 most impactful actions, two of which are consumer-facing: reducing food waste and adopting plant-rich diets.⁵⁵ Other food-system measures in their solutions list include expanding the use of clean cookstoves and reducing deforestation from agricultural expansion and use of biochar.

Project Drawdown is by no means the only effort to highlight the importance of diet in the climate change problem. The *EAT-Lancet Commission Report on Food, Planet, Health* has helped to bring this concept into the mainstream and has generated renewed interest in the idea of food as medicine.⁵⁶ The urgency of responding to climate change has helped force an important convergence between agriculture, nutrition, and environmental communities; climate change and food security have even appeared in the 2020 Democratic primary discourse.⁵⁷ Increasingly, people from different spheres are asking the same question: “How can we produce sufficient food to meet the needs of a growing population and do so in a way that nourishes both people and planet?”

U.S. GOVERNMENT FOOD SECURITY AND CLIMATE CHANGE PROGRAMS

The United States has in place a variety of global food security funds, policies, and programs. Today, Feed the Future, an initiative led by USAID’s Bureau of Food Security, spends more than \$1 billion annually on agriculture-led growth and nutrition in countries around the world. Emergency food assistance through USAID’s Office of Food for Peace (FFP) includes both in-kind commodities (P.L. 480) and cash-based assistance (Emergency Food Security Program).⁵⁸ The United States

The urgency of responding to climate change has helped force an important convergence between agriculture, nutrition, and environmental communities.

was instrumental in launching and is involved in several global movements and initiatives: the public-private partnership-focused New Alliance for Food Security, Scaling Up Nutrition (SUN), and 1,000 Days movements, among others. A whole-of-government Global Food Security Strategy coordinates and guides these efforts. For more information on U.S. government global food security policies and programs, see the CSIS brief *U.S. Policy Roadmap: A Drive to Transform Global Food and Nutrition Security*.⁵⁹

The United States and other donors have long committed to help protect the food security of impoverished communities in the face of climate change, driven by goals to reduce poverty and ensure that hard-won development outcomes are not erased. Because the U.S. global food security space involves broad participation by diverse actors, determining the complete extent of its climate-sensitive investments is a challenge. According to the Organization for Economic Cooperation and Development (OECD) Development Assistance Committee, in 2017 the United States provided just over \$2 billion in climate-sensitive development finance to developing countries, including approximately \$300 million (15 percent) to the food security sector.^{60, 61} These projects cover a variety of themes. Established by USAID and the Consumer Goods Forum, the Tropical Forest Alliance 2020, for example, works with governments and private sector actors to curb deforestation from agricultural activities and supply chains, especially for commodities like soy, beef, palm oil, and paper/pulp. SERVIR, a joint initiative between the National Aeronautics and Space Administration (NASA) and USAID, helps developing countries use Earth-observation satellites to improve environmental decisionmaking and climate services. Other initiatives include a collaboration with the CGIAR on low-emissions agriculture, funding support to the BioCarbon Fund Initiative for Sustainable Forest Landscapes, and participation in the Low Emission Development Strategies Global Partnership, a learning and technical cooperation platform.

In addition to these climate-specific projects and programs, the U.S. government has made efforts to systematically climate-proof its food security development portfolio. The 2014 Executive Order (#13677) on Climate-Resilient International Development—still in effect—requires the “integration of climate-resilience considerations into all United States international development work.”⁶² Evidence of this integration can be seen across U.S. government global food security programming. While initially established exclusively in 19 stable, emerging economies, the second phase of Feed the Future adds resilience as a new strategic objective of the program and reorients it towards more fragile settings in 12 target countries where climate impacts are prevalent and interact with other social, economic, and political forces to drive poverty and instability.⁶³ Meanwhile, through USAID’s FFP, humanitarian programs are increasingly rolling out in response to the increase in climate-related extreme events. FFP’s 2016–2025 Food Assistance and Food Security Strategy squarely includes climate change in its updated conceptual framework and calls for increased collaboration and cross-learning with USAID’s Bureau for Economic Growth, Education, and Environment (E3). FFP also works in close collaboration with the Famine Early Warning Systems Network (FEWS NET), which collaborates with five U.S. agencies providing food security projections in high-risk places around the world and specialized reports on weather and climate.

RECOMMENDATIONS

Establish a position of leadership in climate change and food security international forums. While many U.S. government climate and food security efforts have continued at the technical level, the United States has stepped away in recent years from highly visible, global leadership roles related to climate change, especially the Paris Agreement and Green Climate Fund (GCF), a multilateral funding mechanism designed to help developing countries transition to low-emission, climate-resilient development. The abandonment of this mantle of global leadership—which should be quickly corrected—puts progress in the fight against climate change at great risk. Agriculture, for example, has recently climbed onto the agenda at annual climate negotiations for the first time, after decades of sustained effort. This recognition of agriculture’s role means that developing countries are willing to take steps to reduce the GHG emissions from their agriculture-dominant economies. But they must know that they will be supported, financially

and technically. In 2016, the United States signed an agreement to transfer \$3 billion to the GCF. By early 2017, the GCF had received approximately \$1 billion when the Trump administration indicated that it would provide no additional funds. Without sustained financial support from the United States through the GCF—and any number of multilateral climate funds including the Global Environmental Facility—widespread adoption and scaling of climate-smart agriculture practices will be more difficult to set in motion.

Support domestic efforts to promote climate resilience in food systems:

The credibility and potency of our leadership at global levels begins with our commitment to change and improve our own priorities. Very public controversies around the alleged suppression of research regarding the impact of climate change on food production from the Agricultural Research Service at the U.S. Department of Agriculture (USDA) has brought into question the administration's ability to lead by example. For continued progress in reducing agriculture's global greenhouse gas footprint and improving adoption of climate-smart agricultural practices, the United States must walk the walk here at home. Climate-smart interventions are not limited to developing country contexts. In the United States, cover cropping, for example, has increased considerably, but the practice still represents only a small percentage of planted area. These and other regenerative practices are being rolled out in the United States thanks, in part, to USDA's 10 regional Climate Hubs, led by the Agricultural Research Service and the Forest Service. In this same spirit, the United States should continue and expand its leveraging of domestic university research programs for developing global climate solutions in agriculture. U.S. universities, through the Feed the Future Innovation Labs, are currently involved in research on climate resilient sorghum, wheat, millet, cowpea, chickpea, and beans.⁶⁴ Finally, recent years have seen the emergence of several mechanisms that compensate U.S. farmers for storing carbon in their agricultural soils, including in California and several non-profit and private sector initiatives. These initiatives require federal support to be sustainable in the long run, a step that should be explored within USDA's existing authorities or in the next Farm Bill cycle.

Raise the profile of climate-related food insecurity within U.S. diplomatic and national security strategies. From the National Defense Strategy to the U.S. intelligence community Worldwide Threat Assessment, there is

increased understanding of how food insecurity can drive global instability and that climate change can fan these flames. Driven by the events in the Sahel and Dry Corridor, along with other climate and food security-related conflicts like Darfur (desertification and inter-ethnic violence between pastoralists and farmers) and Syria (drought-related migration from rural to urban areas), climate change and food insecurity have entered the U.S. diplomatic and national security discourse as root drivers of conflict. As noted in a 2012 USAID report, *Frontiers in Development*, “the security challenges posed by fragile and failing states and the deprivation that accompanies them makes it all but inevitable that soldiers and humanitarians, diplomats, and development experts will find themselves operating in increasing proximity to one another, often addressing the same issues with different tools and for complementary purposes.” Food insecurity and climate change, then, must remain at the forefront of U.S. whole-of-government discussions around the humanitarian-development-peace nexus and of the United States' leadership role more broadly in addressing complex global problems. The establishment of a new leadership for Relief, Resilience, and Response (R3) at USAID will help to situate food security and climate change along the entirety of the relief and development spectrum.

Leverage USAID's reorganization to further mainstream climate resilience into U.S. global food security programs.

USAID's proposed reorganization—rightfully well received by the development and humanitarian communities—does not prioritize climate change. The E3 Bureau and its Office of Global Climate Change, which helped shepherd the Global Climate Change and Development Strategy (2012–2018), will cease to exist in the new structure. Climate change experts from E3's Climate Adaptation team will merge with staff from the Office of Water in a new Bureau of Resilience and Food Security. While this merge could help streamline strategies, the symbolic loss of a dedicated office to climate change should not go unnoticed. Steps should be taken to ensure this reduced visibility is not accompanied by reduced action. The reorganization represents a timely opportunity to revisit USAID's 2012 Resilience Policy and to ensure that climate change considerations are central to shock-resistant development and humanitarian-for-development efforts. A guiding resilience framework—one that situates climate change alongside other interrelated stressors—can help USAID effectively deploy its diverse expertise to an equally complex problem. ■

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This brief is made possible by the generous support of *The Bill & Melinda Gates Foundation*.

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Cover Photo: LUIS TATO/AFP/Getty Images

ENDNOTES

1. Amended from Raj Patel, *Stuffed and Starved: The Hidden Battle for the World Food System* (Brooklyn, N.Y.: Melville House Pub., 2007).
2. Food Security Information Network (FSIN), *Global Report on Food Crises 2019* (FSIN, 2019), http://www.fsinplatform.org/sites/default/files/resources/files/GRFC%202019_Full%20Report.pdf.
3. Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD), United Nations Children's Fund (UNICEF), World Food Programme (WFP), and World Health Organization (WHO), *The State of Food Security and Nutrition in the World: Safeguarding Against Economic Slowdowns and Downturns* (Rome: FAO, 2019), <http://www.fao.org/3/ca5162en/ca5162en.pdf>.
4. FAO et al., *The State of Food Security*.
5. United Nations Office for the Coordination of Humanitarian Affairs (OCHA), *Global Humanitarian Overview 2019* (Geneva: OCHA, 2019), <https://www.unocha.org/sites/unocha/files/GHO2019.pdf>.
6. Intergovernmental Panel on Climate Change (IPCC), *Climate Change and Land* (IPCC, 2019), https://www.ipcc.ch/site/assets/uploads/2019/08/Edited-SPM_Approved_Microsite_FINAL.pdf.
7. Atmospheric physicists measure CO₂ in parts per million (ppm). At the time of the Industrial Revolution, atmospheric concentrations of CO₂ measured 275ppm. Today, that concentration has increased to 420ppm and, if left unchecked, is expected to rise to 550ppm over the next half century.
8. FAO, International Fund for Agricultural Development (IFAD), and WFP, *The State of Food Insecurity in the World* (Rome: FAO, 2015), <http://www.fao.org/3/a-i4646e.pdf>.
9. WFP, *Climate-Related Disasters and Food Insecurity in 2017: Preparedness and Response* (WFP), <https://docs.wfp.org/api/documents/WFP-0000023693/download/>.
10. Matthew Smith and Samuel Myers, "Impact of anthropogenic CO₂ emissions on global human nutrition," *Nature Climate Change* 8 (2018): 834–839, <https://www.nature.com/articles/s41558-018-0253-3>.
11. FAO, *State of Food and Agriculture 2013: Food Systems for Better Nutrition* (Rome: FAO, 2013), <http://www.fao.org/publications/sofa/2013/en/>.
12. J.R. Porter et al., "Food Security and Food Production Systems," in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. C.B. Field et al. (Cambridge, UK and New York: Cambridge University Press, 2014), 48–533.
13. John Williams, Stephen Jackson, and John Kutzbach, "Projected distributions of novel and disappearing climates by 2100 AD," *Proceedings of the National Academy of Sciences of the United States of America* 104, no. 14 (2007): 5738–5742, <https://doi.org/10.1073/pnas.0606292104>.
14. FAO, Aquastat Database, http://www.fao.org/nr/water/aquastat/water_use/index.stm.
15. IPBES, "Report of the Plenary of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on the work of its seventh session," 2019, https://www.ipbes.net/system/tdf/ipbes_7_10_add-1-_advance_0.pdf?file=1&type=node&id=35245.
16. J.R. Porter et al., "Food Security and Food Production Systems," in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. C.B. Field et al.
17. FAO, *The State of the World's Biodiversity for Food and Agriculture* (Rome: FAO, 2019), <http://www.fao.org/3/CA3129EN/CA3129EN.pdf>.
18. FAO, *State of Food and Agriculture: Climate Change, Agriculture and Food Security* (Rome: FAO, 2016), <http://www.fao.org/3/a-i6030e.pdf>.
19. Noah Diffenbaugh and Marshall Burke, "Global warming has increased global economic inequality," *Proceedings of the National Academy of Sciences of the United States of America* 116, no. 20 (2019): 9808–9813, <https://doi.org/10.1073/pnas.1816020116>.
20. Alex de Waal, *Mass Starvation: The History and Future of Famine* (Cambridge, UK: Polity Press, 2018).
21. FAO et al., *The State of Food Security*.
22. The "hunger season" refers to the time of year for subsistence farming families that typically coincides with the rainy season, when crops are growing but not yet harvested and last year's food stocks have run out.
23. Wenju Cai et al., "Increasing frequency of extreme El Niño events due to greenhouse warming," *Nature Climate Change* 4 (2014): 111–116, <https://www.nature.com/articles/nclimate2100>.
24. FAO et al., *The State of Food Security*.
25. FAO, *How to Feed the World in 2050* (Rome: FAO, 2009), http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf.
26. World Bank, *World Development Report 2008: Agriculture for Development* (Washington, D.C.: World Bank, 2008), <https://openknowledge.worldbank.org/handle/10986/5990>.
27. FAO, *Tackling Climate Change Through Livestock: A Global Assessment of Emissions and Mitigation Opportunities* (Rome: FAO, 2013), <http://www.fao.org/3/i3437e/i3437e.pdf>.
28. Eric Oelkers and David Cole, "Carbon dioxide sequestration: a solution to the global problem," *Elements* 4 (2008): 305–310, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.818.8787&rep=rep1&type=pdf>.
29. H. Eswaran, R. Lal, and P.F. Reich, "Land Degradation: An Overview," in *Proceedings of the 2nd International Conference on Land Degradation and Desertification* (Khon Kaen, Thailand: Oxford Press).
30. FAO, *Global Food Losses and Food Waste: Extent, Causes and Prevention*, (Rome: FAO, 2011), <http://www.fao.org/3/mb060e/mb060e.pdf>.
31. WFP, *Zero Loss for Zero Hunger: Preserving Harvests: Eradicating Hunger* (WFP) https://documents.wfp.org/stellent/groups/public/documents/reports/wfp289791.pdf?_ga=2.213735639.2112710292.1569252487-973524119.1525373566.
32. Department of Defense, *Quadrennial Defense Review 2014* (DOD, 2014), https://archive.defense.gov/pubs/2014_quadrennial_defense_review.pdf.
33. Department of Defense, *National Security Implications of Climate-Related Risks and a Changing Climate* (DOD, 2015), <https://archive.defense.gov/pubs/150724-congressional-report-on-national-implications-of-climate-change.pdf?source=govdelivery>.
34. United Nations and World Bank, *Pathways for Peace: Inclusive Approaches to Preventing Violent Conflict* (Washington, DC: 2018), <https://openknowledge.worldbank.org/handle/10986/28337>.
35. Organization for Economic Cooperation and Development (OECD), *States of Fragility 2015: Meeting Post-2015 Ambitions* (OECD, 2015), <https://www.oecd.org/publications/states-of-fragility-2015-9789264227699-en.htm>.
36. United Nations High Commissioner for Refugees (UNHCR), *Global Trends in Forced Displacement in 2018* (UNHCR, 2019), <https://www.unhcr.org/5d08d7ee7.pdf>.
37. FAO et al., *The State of Food Security*.
38. United Nations Environment Programme (UNEP), *From Conflict to Peace-*

- building: *The Role of Natural Resources and the Environment* (Geneva: UNEP, 2009), https://postconflict.unep.ch/publications/pcdmb_policy_01.pdf.
39. OCHA, *The Sahel: Converging Challenges, Compounding Risks* (OHCA, 2016), https://reliefweb.int/sites/reliefweb.int/files/resources/sahel_info_sheet_052016.pdf.
40. IPCC, “Fifth Climate Change Assessment Report: Impacts, Adaptation and Vulnerability,” Working Group II, 2014, <https://www.ipcc.ch/report/ar5/wg2/>.
41. Nathalie Thomas and Sumant Nigam, “Twentieth-Century Climate Change over Africa: Seasonal Hydroclimate Trends and Sahara Desert Expansion,” *Journal of Climate* 31, no. 9 (2018): 3349–3370, <https://doi.org/10.1175/JCLI-D-17-0187.1>.
42. UNEP, *The Tale of a Disappearing Lake* (UNEP, 2018), <https://www.unenvironment.org/news-and-stories/story/tale-disappearing-lake>.
43. Regional Bureau for Africa, United Nations Development Programme (UNDP), *Journey to Extremism in Africa* (UNDP, 2017), <https://journey-to-extremism.undp.org/content/downloads/UNDP-JourneyToExtremism-report-2017-english.pdf>.
44. Thomas Waldhauser, *Statement of General Thomas D. Waldhauser, United States Marine Corps, Commander United States Africa Command, Senate Committee on Armed Services, February 7 2019: A Secure, Stable, and Prosperous Africa is an Enduring American Interest*, https://www.armed-services.senate.gov/imo/media/doc/Waldhauser_02-07-19.pdf.
45. Kanta Kumari Rigaud et al., *Groundswell: Preparing for Internal Climate Migration* (Washington, DC.: World Bank, 2018), <https://openknowledge.worldbank.org/handle/10986/29461>.
46. WFP, *At the Root of Exodus: Food Security, Conflict and International Migration* (WFP, 2017), https://docs.wfp.org/api/documents/WFP-0000015358/download/?_ga=2.173431136.2112710292.1569252487-973524119.1525373566.
47. FAO, *Situation Report: Dry Corridor Central America* (Rome: FAO, 2016), <http://www.fao.org/3/a-br092e.pdf>.
48. *Food Security and Emigration: Why people flee and the impact on family members left behind in El Salvador, Guatemala and Honduras* (Panama City: WFP, 2017), https://docs.wfp.org/api/documents/WFP-0000022124/download/?_ga=2.177100902.2112710292.1569252487-973524119.1525373566.
49. International Organization for Migration (IOM), London School of Economics and Political Science (LSE), Organization of American States (OAS), and WFP, *Hunger Without Borders: The Hidden Links Between Food Insecurity, Violence and Migration in the Northern Triangle of Central America*, (WFP, 2015), https://documents.wfp.org/stellent/groups/public/documents/liaison_offices/wfp277544.pdf.
50. Congressional Research Service, “Central American Migration: Root Causes and U.S. Policy: Updated June 13, 2019,” Federation of American Scientists, <https://fas.org/sgp/crs/row/IF11151.pdf>.
51. WFP USA, *Winning the Peace: Hunger and Instability* (WFP USA, 2017), https://www.wfpusa.org/wp-content/uploads/2019/03/wfp_food_security_final-web-1.pdf.
52. IFAD, *2019 Rural Development Report: Creating Opportunities for Rural Youth* (IFAD, 2019), https://www.ifad.org/documents/38714170/41133075/RDR_report.pdf/7282db66-2d67-b514-d004-5ec25d9729a0.
53. Chase Sova et al., *Bringing the Concept of Climate-Smart Agriculture to Life: Insights from CSA Country Profiles Across Africa, Asia, and Latin America* (World Bank and the International Centre for Tropical Agriculture, 2018), <http://documents.worldbank.org/curated/en/917051543938012931/pdf/132672-WP-P168692-PUBLIC-4-12-2018-12-27-47-CSAInsightsfromCSAProfiles.pdf>.
54. CGIAR was formerly known as Consultative Group on International Agricultural Research.
55. Paul Hawken, *Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming* (New York: Penguin Books, 2016).
56. Walter Willett et al., “Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems,” *The Lancet Commissions* 393, no. 10170 (2019): 447–492, [https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736\(18\)31788-4.pdf?utm_campaign=tleat19&utm_source=HubPage](https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(18)31788-4.pdf?utm_campaign=tleat19&utm_source=HubPage).
57. Charlie Mitchell, “Climate Town Hall Brings Food and Agriculture to Center Stage,” *Civil Eats*, September 5 2019, <https://civileats.com/2019/09/05/climate-town-hall-brings-food-and-agriculture-to-center-stage/>.
58. At the time of publication, USAID is undergoing a process of organizational reform, in which the Office of Food for Peace will be combined with the Office of U.S. Foreign Disaster Assistance into a new Bureau for Humanitarian Assistance. The Bureau of Food Security, meanwhile, will become the Bureau of Resilience and Food Security.
59. Kimberly Flowers, *U.S. Policy Roadmap: A Drive to Transform Global Food and Nutrition Security* (Washington, D.C.: Center for Strategic and International Studies [CSIS], 2019), https://csis-prod.s3.amazonaws.com/s3fs-public/publication/190104_GlobalFoodandNutrition.pdf.
60. Development Assistance Committee, OECD, *Climate-Related Development Finance Data* (OECD, 2018), <http://www.oecd.org/dac/financing-sustainable-development/development-finance-topics/Climate-related-development-finance-in-2018.pdf>.
61. Overseas development assistance provided by the United States in 2017 totaled \$35.3 billion, the largest single country contribution.
62. Office of the Press Secretary, “Executive Order 13677: Climate-Resilient International Development,” The White House, <https://obamawhitehouse.archives.gov/the-press-office/2014/09/23/executive-order-climate-resilient-international-development>.
63. Julie Howard and Emmy Simmons, *Risk and Resilience: Advancing Food and Nutrition Security in Nigeria Through Feed the Future* (Washington, DC: CSIS, 2019), https://csis-prod.s3.amazonaws.com/s3fs-public/publication/190212_NigeriaResilience_WEB.pdf.
64. A complete list of Feed the Future Innovation Labs can be found at <https://www.feedthefuture.gov/feed-the-future-innovation-labs/>.