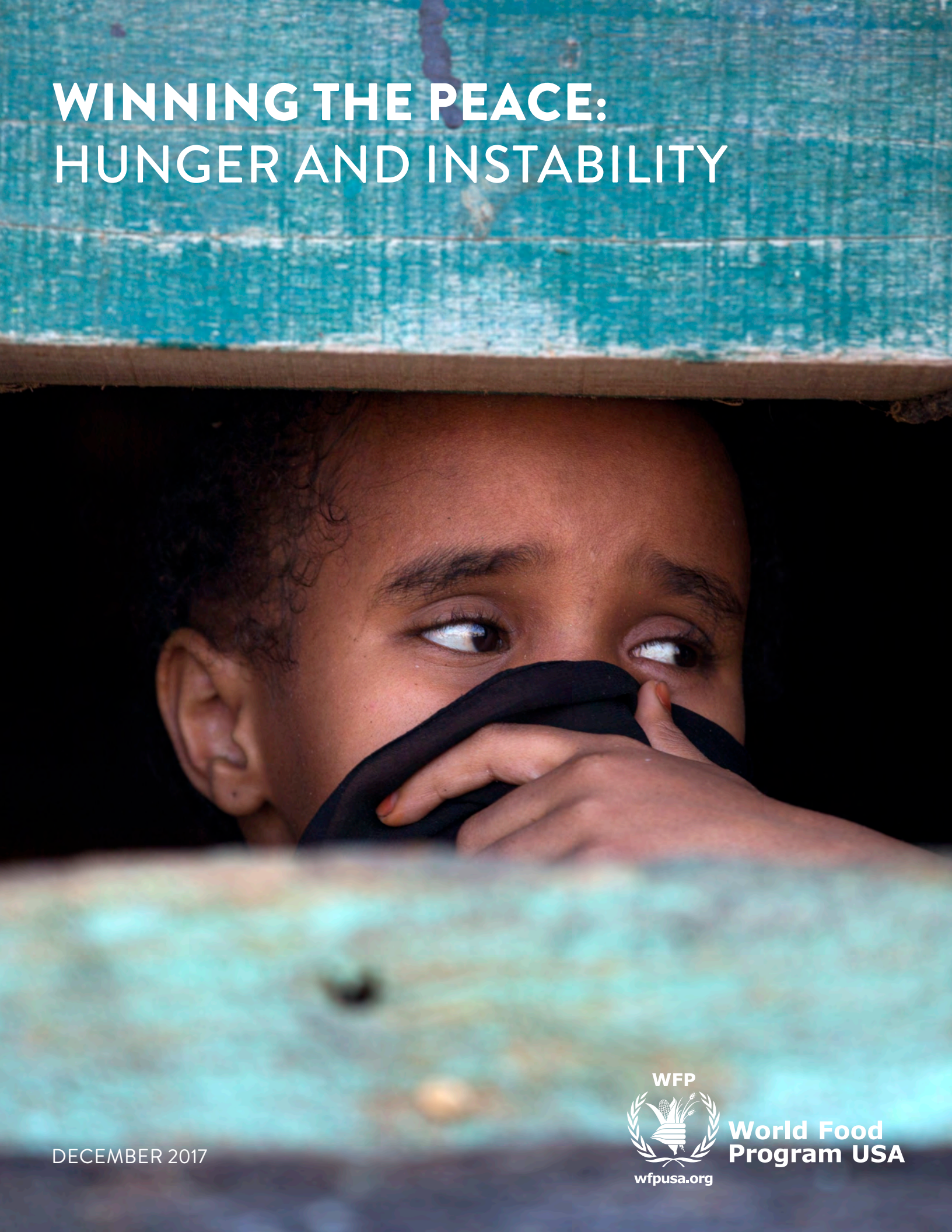
WINNING THE PEACE:
HUNGER AND INSTABILITY



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World Food Program USA is a 501(c)(3) non-profit organization that proudly supports the mission of the United Nations World Food Programme, the leading agency fighting hunger. By mobilizing individuals, lawmakers and businesses in the U.S. to advance the global movement to end hunger, we bolster an enduring American legacy of feeding families in need around the world. The views and opinions expressed in this report are those of World Food Program USA and do not necessarily reflect the official position of the World Food Programme.

"Winning the Peace: Hunger and Instability" was produced within WFP USA's Public Policy Department, under the leadership of Rick Leach, WFP USA's President and CEO, and Deborah Saidy, Vice President, Public Policy. Dr. Chase Sova, Director of Public Policy and Research, served as the primary author of the report and Galen Fountain, Consultant, provided strategic research support. "Winning the Peace" has benefited from expertise from across WFP USA's Departments and from comments provided by several third-party reviewers. The authors would like to extend their deepest gratitude to all involved in the production of this report.

Cover photo: WFP/Karel Prinsloo

Foreword

Though we represented different parties in the U.S. Senate, eradicating global hunger has always been a cause that united us. Growing up in Kansas and South Dakota, respectively, we each spent summers working on the farm, learning firsthand the process of putting food on America's tables. Decades later, in Congress, these experiences helped shape our careers. Ensuring food security, both at home and abroad, became a central issue for both of us—because it is not only the right thing to do, but also one of the best ways to invest taxpayer dollars.

Throughout modern history, the U.S. has led the global fight against hunger and famine, from the Marshall Plan to the Food for Peace and the McGovern-Dole school nutrition programs. Beyond the moral leadership and economic benefits generated by these investments, international food assistance also protects our own national security interests by enhancing global stability. It was true after World War II and it holds just as true today.

Unprecedented numbers of people throughout the world are displaced by conflict, catastrophic weather events and natural disasters. War and persecution have displaced more than 65 million people today, many of whom have fled their own countries, placing a great burden on the low-and middle-income countries hosting them. Meanwhile, for the first time in more than a decade, the number of hungry people is on the rise again—increasing from 777 million in 2015 to 815 million in 2016. Almost 60 percent of those 815 million undernourished people live in countries affected by conflict.

War contributes to the disruption of food systems and produces hunger. More people died of starvation in World War II than from fighting. This relationship also exists in the opposite direction: Hunger produces instability. When people do not have enough food to feed themselves or their families, they are more likely to make decisions out of desperation. This manifests itself in diverse ways: Sometimes in social unrest and protest, and other times in recruitment to violent movements offering short-term relief in exchange for loyalty to depraved ideologies.

History shows us that U.S. leadership is essential in fighting hunger and promoting global stability. We must continue to provide that leadership as a nation, building on a long legacy of bipartisan cooperation that we proudly championed during our time in Congress. But we must also go further than we have before in an effort to keep pace with growing global needs and unprecedented challenges. If we turn our backs on the world's hungry, we lay the foundation for a deteriorating and, ultimately, threatening world order.

Sen. Bob Dole
Former Majority Leader

Sen. Tom Daschle
Former Majority Leader

Preface

The world is facing a humanitarian crisis on a scale never before seen. For the first time in a decade, the number of hungry people is on the rise, and families suffering from violence, conflict and persecution are crossing borders in record numbers. Both threaten global stability and to roll back years of development progress.

Food insecurity is both a consequence and a driver of global instability. The former—food insecurity as a byproduct of war—is well understood. Conflict displaces people, topples markets and destroys critical infrastructure, each undermining agricultural production and access to food. The ways in which food insecurity serves as a driver of instability itself, though self-evident, is less well documented, and has traditionally lacked a strong empirical base to support the anecdotal understanding of this relationship. It was this gap that we set out to fill through this report. The timing of this work is critical for several reasons.

First, the dominant driver of today's humanitarian crises is conflict. Ten of the World Food Programme's (WFP) 13 largest and most complex emergencies are driven by conflict, and responding to war and instability represents 80 percent of all humanitarian spending today. These crises are stretching humanitarian organizations beyond their limits. Understanding how food insecurity drives instability is critical to developing strategies to help alleviate this important driver of insecurity.

Second, the evidence base on the food insecurity and instability relationship—in the form of peer reviewed academic journal articles—has grown substantially in the last decade. In fact, almost three quarters of studies examined in this report were produced in the last five years. This work is timely in capturing a wealth of new studies only recently produced. These studies have served to widen the geographic distribution of analyses, introduce new control variables and qualitative checks, and ultimately to improve our understanding of the conditions mediating the relationship between food insecurity and instability.

Third, given the magnitude of the humanitarian crisis and its impact on global stability, advocates for foreign assistance spending in the U.S. and beyond must begin to gather a broader coalition of support to ensure that the immediate, lifesaving needs of vulnerable people are met. In 2016, only 56% of the $22.1 billion requested in the global humanitarian appeal was provided. Securing the political will to meet these immediate needs necessarily involves understanding the diverse rationale for supporting humanitarian operations—moral, economic and security.

Acknowledging the security dividends of humanitarian assistance does not simultaneously imply that we abandon our core principles for providing international assistance based on objective need, neutrality and impartiality. Similarly, responding to conflict-driven crises does not constitute a tradeoff between meeting the needs of the world's most vulnerable and ensuring global stability; they increasingly are one and the same.

Richard Leach
President & CEO
World Food Program USA

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Executive Summary

The relationship between food insecurity and instability dates back to the origins of human existence, long before the establishment of modern agriculture and today's globalized food supply chain. The evidence presented in this report shows that, even in today's modern world, the relationship between food insecurity and instability remains strong and has critical implications for how the world addresses global security challenges.

While the link between food insecurity and instability is intrinsically understood in policy and academic circles, it has seen increased attention in recent years due to the changing nature of global conflicts and the current scale of humanitarian need. Today, the humanitarian system is defined by the following characteristics:

- For the first time in a decade, the number of hungry people in the world is on the rise. In 2016, 815 million people were undernourished, an increase of 38 million people from 2015. Almost 500 million of the world's hungry live in countries affected by conflict.
- The number of people who are acutely food-insecure (in need of emergency assistance) rose from 80 million in 2016 to 108 million in 2017—a 35 percent increase in a single year.
- Over 65 million people are currently displaced because of violence, conflict and persecution—more than any other time since World War II.
- For the first time in history, the world faces the prospect of four simultaneous famines in northeast Nigeria, Somalia, South Sudan and Yemen. Each of these crises is driven by conflict.
- Increased migration and the spilling of conflicts beyond borders has led to a proliferation of, and interest in, "fragile states"—states defined by "the absence or breakdown of a social contract between people and their government."
- By 2030, between half and two-thirds of the world's poor are expected to live in states classified as fragile. While a decade ago most fragile states were low-income countries, today almost half are middle-income countries.

Meanwhile, the international system of governance, as defined by the nation state, is evolving. A main "weapon" of modern conflict is information, allowing non-state actors to undermine traditional nation states in more consequential ways, attacking their legitimacy

rather than their military power. Non-traditional security threats—like food insecurity—can serve as drivers of recruitment for non-state actors, furthering destabilization. Such threats cannot be addressed through military responses alone.

Many political and military leaders, acknowledging this new reality, have recognized the importance of "smart power" in the form of foreign assistance, especially food assistance and agricultural development. “Show me a nation that cannot feed itself,” remarked Senator Pat Roberts (R-KS), “and I'll show you a nation in chaos.” Perhaps the most widely cited development-security reference comes from the current U.S. Secretary of Defense, General James Mattis. In Congressional testimony in 2013, when he was serving as Commander of U.S. Central Command, the General remarked, “If you don't fund the State Department fully, then I need to buy more ammunition.”

Given that food insecurity is intimately related to other forms and causes of extreme poverty and deprivation, establishing a causal link between food insecurity and instability, broadly defined, is methodologically challenging, even while the connection is intuitively understood. As a result, the relationship is most often cited anecdotally. The failure to respond adequately to drought conditions, for example, is widely accepted as a contributing factor to political regime change in Ethiopia both in the 1970s and the 1980s. More recently, food price riots contributed to the toppling of governments in Haiti and Madagascar in 2007 and 2008 and violent protest in at least 40 other countries worldwide. Production shocks and price spikes in 2011 were similarly linked to the social unrest of the Arab Spring, and the ongoing Syria crisis has clear links to prolonged, historic drought conditions affecting food supplies. Meanwhile, Darfur has been branded the “first climate change conflict” by many observers. Most recently, the mutually reinforcing nature of food insecurity and instability has been increasingly cited as it relates to the four looming famines in northeast Nigeria, Somalia, South Sudan and Yemen.

Seeking to capture insights from a growing body of literature and to summarize the evidence base, we conducted a review of the literature on the links between food insecurity and national, regional and global instability, drawing from a body of over 3,000 peer-reviewed journal articles. A summary of the key findings follows.

While food-related instability is subject to many individual conditions, the weight of the collective evidence is unmistakable: Food insecurity is linked to instability. Approximately 95% of peer-reviewed studies examined in this report were able to establish an empirical link between food insecurity and instability. Specifically, we find that 77 percent (41 of 53) of studies in our sample determine the relationship to be positively correlated, 17 percent (9 of 53) partially correlated and only 6 percent (3 of 53) without correlation.

The relationship between food insecurity and instability is complex and best understood as the sum of its many parts. Throughout the course of this investigation, we have surfaced at least 11 unique drivers of food insecurity—from land competition and food price spikes to rainfall variability—and 9 separate manifestations of social unrest, ranging from peaceful protest to violent interstate conflict.

Drivers	**Manifestations**
Land Competition	Social Unrest
Water Competition	Political Instability
Food Price Spikes	Riots
Food Price Volatility	Isolated Violent Conflict
Food Price Uncertainty	Homicide
Agricultural Production or Wage Loss	Terrorism or Extremism
Undernourishment	Armed Conflict
Economic Reliance on Agriculture	Civil War
Drought	Interstate Conflict
Rainfall Variability	
Temperature Fluctuations	

Hungry people are not always violent, and violent people are not always hungry. Riots often occur among more affluent populations suffering from transitory food insecurity, but not chronic hunger. The world's chronically hungry, meanwhile, are disproportionately located in rural areas characterized by vast geographies and limited communication technology—these populations very often suffer in silence.

While temporary food insecurity from price spikes most often fuels urban unrest, **more consequential rebellions or extremist movements tend to take root in predominantly rural areas** that are more distant from government services and more difficult to police.

Modern conflicts are almost never driven by a single cause. What is striking is how quickly natural disasters can be the catalyst for manmade crises, either through the state's failure to intervene or an inappropriate intervention by the state. These responses are often more powerful drivers of food-related instability than shock-events themselves. Ultimately, every instance of food-related instability can be characterized by a unique combination of "drivers" and individual "motivators."

Individual motivations for involvement in food-related social unrest and violence vary between contexts and people, but generally fall into three categories:

(1) Grievance refers to actions motivated by a perceived injustice. The grievance motivation is especially potent when food insecurity provides an impetus for the airing of longstanding societal divisions, allowing a population to cleave along pre-established lines. When food insecurity "breaks the camel's back," exacerbating longstanding tensions, the grievance motivation is at play.

(2) Greed (economic) motivation occurs when there is a clear economic advantage to resorting to violence. This motivation is often reduced to a simplified equation: Does engaging in violent conflict or revolt yield a higher economic and social return than the status quo (i.e. is there a compelling opportunity cost of inaction)? This often plays out with rebel groups paying wages—or offering food—as a recruitment incentive, effectively taking advantage of the desperation felt by those unable to feed themselves or their families.

(3) Governance motivation occurs in the context of unachieved expectations or a failure of the state to prevent food insecurity. Additionally, when the state's ability to enforce rule-of-law is diminished or non-existent, it is easier for economic or grievance-motivated individuals to make the decision to engage in conflict without fear of punitive repercussion.

The drivers of food-related instability can be grouped into three interrelated categories:

(1) Agricultural resource competition (e.g. land and water): When permanent resources like land and water are inadequate to sustain agricultural livelihoods, the risk of instability rises markedly. This manifests in conflicts between pastoral and sedentary agricultural communities, but also through land grabs, inadequate land tenure laws and state-run land redistribution measures, among others. Resource competition is exacerbated by increased human migration, especially between ethnically diverse communities.

(2) Market failure: Food price spikes, price uncertainty and price volatility have all been linked to the onset of social unrest, usually in the form of demonstrations or riots. This most commonly occurs in urban areas, with food products of cultural significance, and among countries with a strong reliance on agricultural imports. Context, including the commodity type, governance regime and the perceived cause of the food price rise, has a tremendous effect on the intensity and duration of food riots.

(3) Extreme weather (e.g. drought): Market failure and agricultural resource competition are often driven by short-term variations in weather and climate creating desperate conditions for individuals, especially in the developing world, whose primary occupation is growing food.

While we intuitively think of social and political unrest resulting from agricultural resource scarcity, **the likelihood and duration of conflict can be partially dependent on the abundance of resources.** Supplying a successful rebellion is a resource-intensive process, and even if rebels have the motive to fight, they also require the means; after all, "an army marches on its stomach." Several authors in this review identified resource abundance as a condition for certain types of conflict onset and duration.

Hunger and instability are mutually reinforcing. Roughly 80 percent of countries that are severely food-insecure are also considered "fragile" or "extremely fragile" (51 of 64 countries), and vice versa. By 2030, between half and two-thirds of the world's poor are expected to live in states classified as fragile—simultaneously driven by, and producing, greater food insecurity.

There are several strategies that can break the food insecurity-instability relationship. A comprehensive approach to addressing the many faces of food insecurity is required, including emergency food assistance, agricultural development, child nutrition, and social safety net systems.

(1) Emergency food assistance: Provides immediate relief from the impacts of manmade and natural crises, serving as the last line of lifesaving assistance to those in need and decreasing the desperation felt by people suffering from extreme hunger. When administered effectively, food assistance can reduce food price volatility and uncertainty, building trust in food systems; can provide livelihood opportunities that increase the "cost" of engaging in violent conflict; and can be effective tools in the battle for hearts and minds (e.g. U.S. food

aid is branded “From the American People”). Food assistance has also been successfully deployed as a means to entice combatants to lay down their arms and reintegrate into society.

(2) Agricultural development: Food assistance alone cannot prevent conflict or the re-emergence of conflict once peace has been achieved. Almost half of the world’s hungry are subsistence farmers. GDP growth in the agricultural sector is more than twice as effective at reducing extreme hunger and poverty than growth in other sectors in developing countries. Investments in subsistence farmers—especially women—can have a deep impact in reducing hunger and extreme poverty and improving self-sufficiency, with positive spillover effects into the wider economy. Agricultural development, for its outsized effect on economic growth, can be especially effective at deterring recruitment for violent uprisings and delivering peace dividends.

(3) Childhood malnutrition: Early childhood nutrition can have lifetime impacts on health and prosperity. Lacking proper nutrition at an early age, physical growth and intellectual development can be permanently damaged, leading to long-term negative impacts on individual achievement as well as broader economic growth and stability. More than 50 percent of those displaced from their countries by conflict, violence and persecution are under the age of 18. Children who do not receive adequate nutrition face physical, emotional and economic “stunting” that plagues them throughout their lives and makes them more prone to violence and aggression.

(4) Safety net systems: Safety net systems—the predictable transfer of basic commodities, resources or services to poor or vulnerable populations— protect against societal shocks and episodic bouts of food insecurity, allowing people to preserve productive assets and preventing vulnerable populations from further descending into extreme poverty. "Food-for-work" asset-building initiatives have been promoted as effective deterrents of terrorist recruitment, providing viable livelihood opportunities for vulnerable populations. Food and cash transfers have also proved successful in deterring riots, as evidenced in the 2007-2008 food price crisis. Meanwhile, school meals—the most widely deployed safety net—provide structure, normalcy and protection against childhood recruitment into armed groups.

The Link Between Hunger and Instability

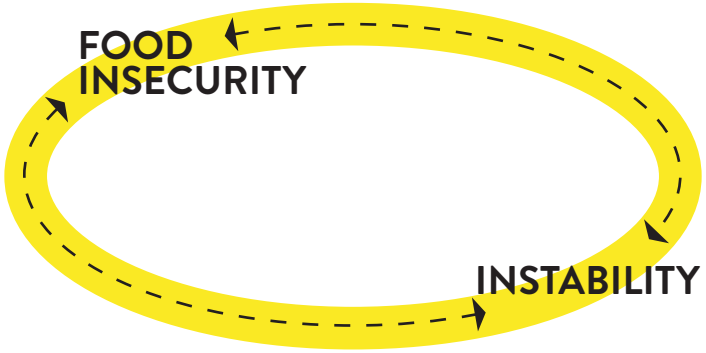
1: Understanding the link

DRIVERS
The drivers of food-related instability can be broadly grouped into three interrelated categories

MOTIVATORS
Individual motivations for involvement in unrest and violence vary between contexts, but generally fall into three categories

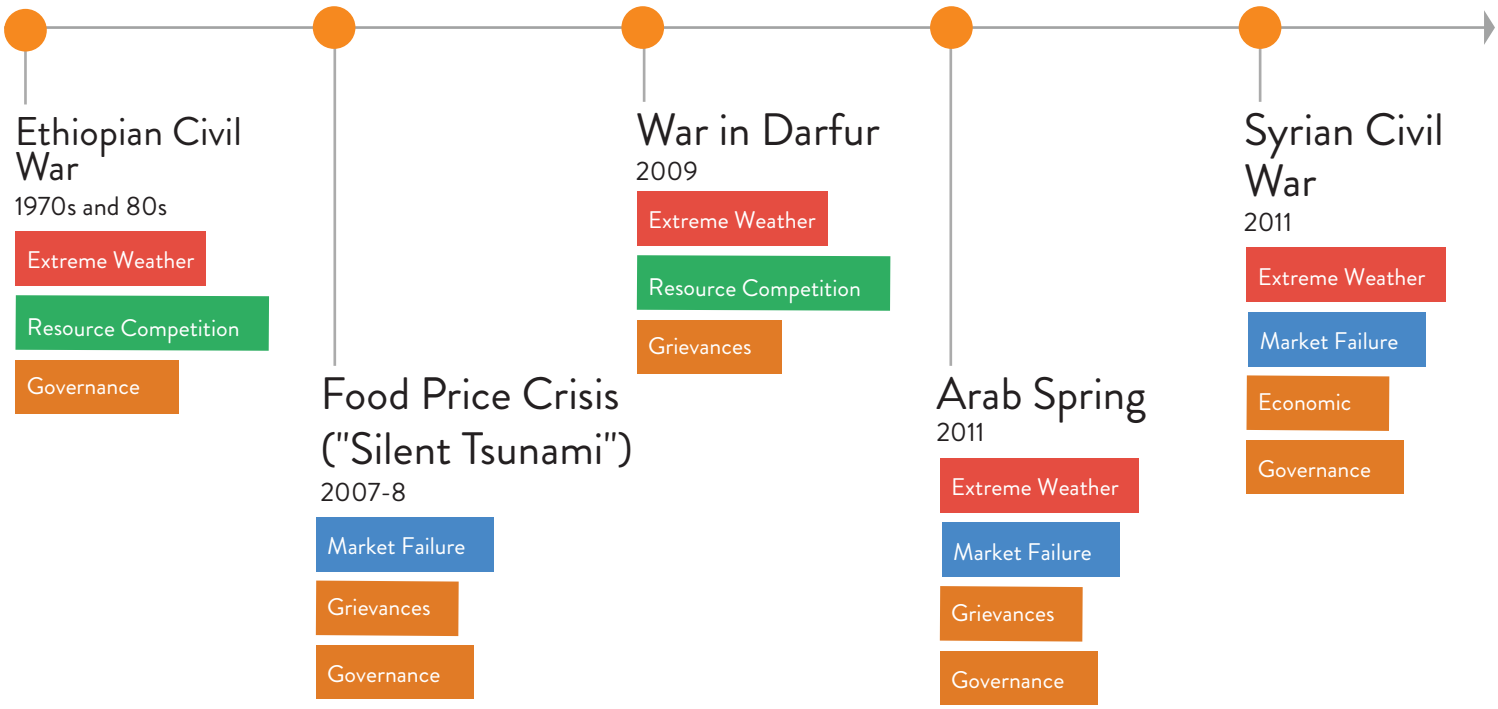
3. The feedback loop

A consistent feature in food-related instability is a feedback loop where food insecurity produces instability and instability produces further food insecurity



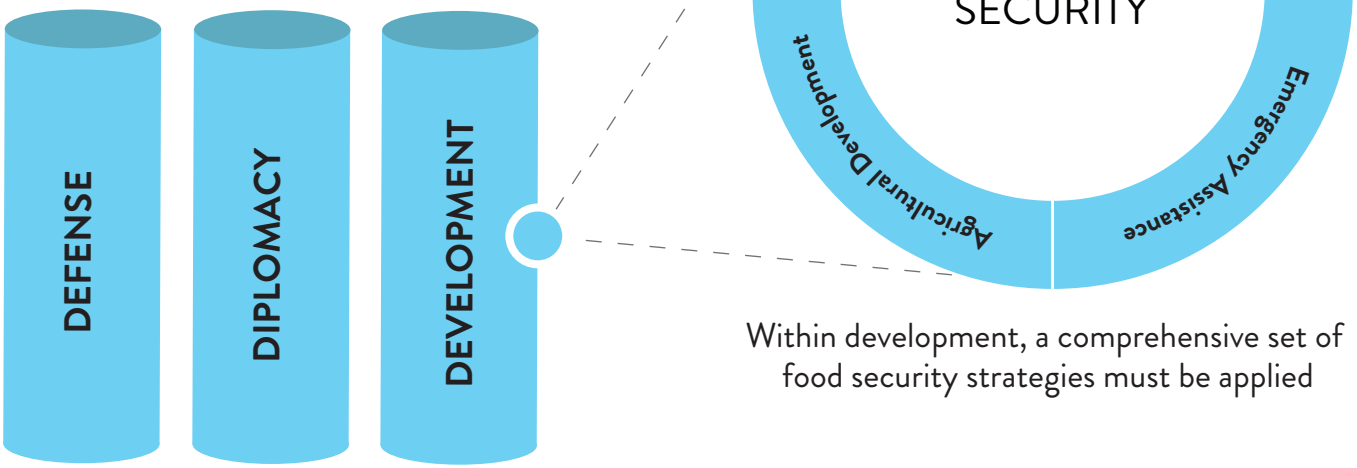
2. The link in recent history

While any instance of food-related instability will likely involve all drivers and motivators, each example provided here has a unique combination of *prevailing* drivers and motivators



4. Severing the link

Disrupting the link between drivers and motivators and food-related instability requires defense, diplomacy and development actors to work in unison



Within development, a comprehensive set of food security strategies must be applied

1. Introduction

Caption: Marouf, a Syrian refugee, is accompanied by his daughter Noor to Tazweed supermarket in the Zaatari refugee camp in Jordan.
Credit: WFP/Ellie Kealey

1.a The state of food insecurity and the global humanitarian crisis

The relationship between food and conflict dates back to the origins of human existence, long before the establishment of modern agriculture and today's globalized food supply chain. Communities of foraging *Homo Sapiens* clashed tens of thousands of years ago in territorial disputes over food supplies, and the pursuit of food sovereignty led to—and allowed for— the territorial expansion of ancient global empires. In fact, throughout all of history, food has simultaneously fueled the machines of war and provided the foundations for peace. The quest for food is so fundamental that it is built into our genetic material.

In recent years, increased attention has been paid to the food-stability nexus as a result of the changing nature of global conflicts and the current scale of humanitarian need. Today, an estimated 108 million people are in need of emergency food assistance while famine threatens four countries in Africa and the Middle East. Meanwhile, 65 million people are currently displaced because of violence, conflict and persecution—more than any other time since World War II (UNHCR 2016). The average length of displacement is 17 years. Today, the vast majority of global humanitarian assistance is directed toward countries experiencing protracted conflict. In these settings, food insecurity is nearly three times higher than in other developing country settings (Maxwell 2013). In short, prolonged human-induced conflict is the new norm in humanitarian emergencies.

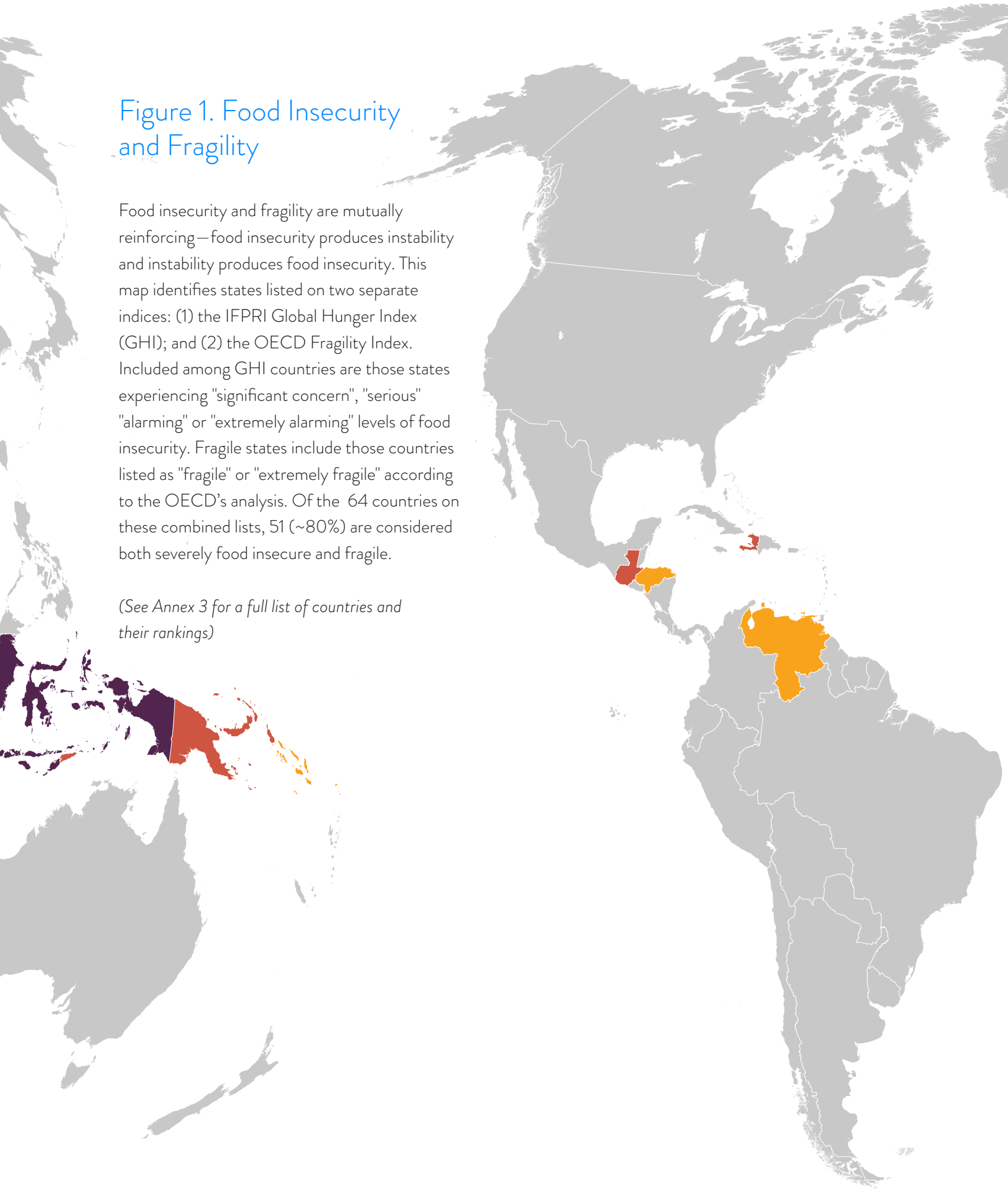
Importantly, these crises are not easily contained within fixed borders, threatening regional and global security. Countries around the world are collectively hosting 21.5 million refugees. The Syria crisis alone, now in its seventh year, has seen the displacement of more than 11 million people, 5 million of whom have crossed over into neighboring countries. It is notable that Syria itself hosted 1.5 million Iraqi refugees between 2003 and 2007 prior to the eruption of violence in 2011 (Kelley, Mohtadi et al. 2015). Only 10 percent of these Syrian refugees are living in camps, while the remainder occupy urban and peri-urban areas, placing additional stress on fast-growing cities and rural areas' ability to feed them.

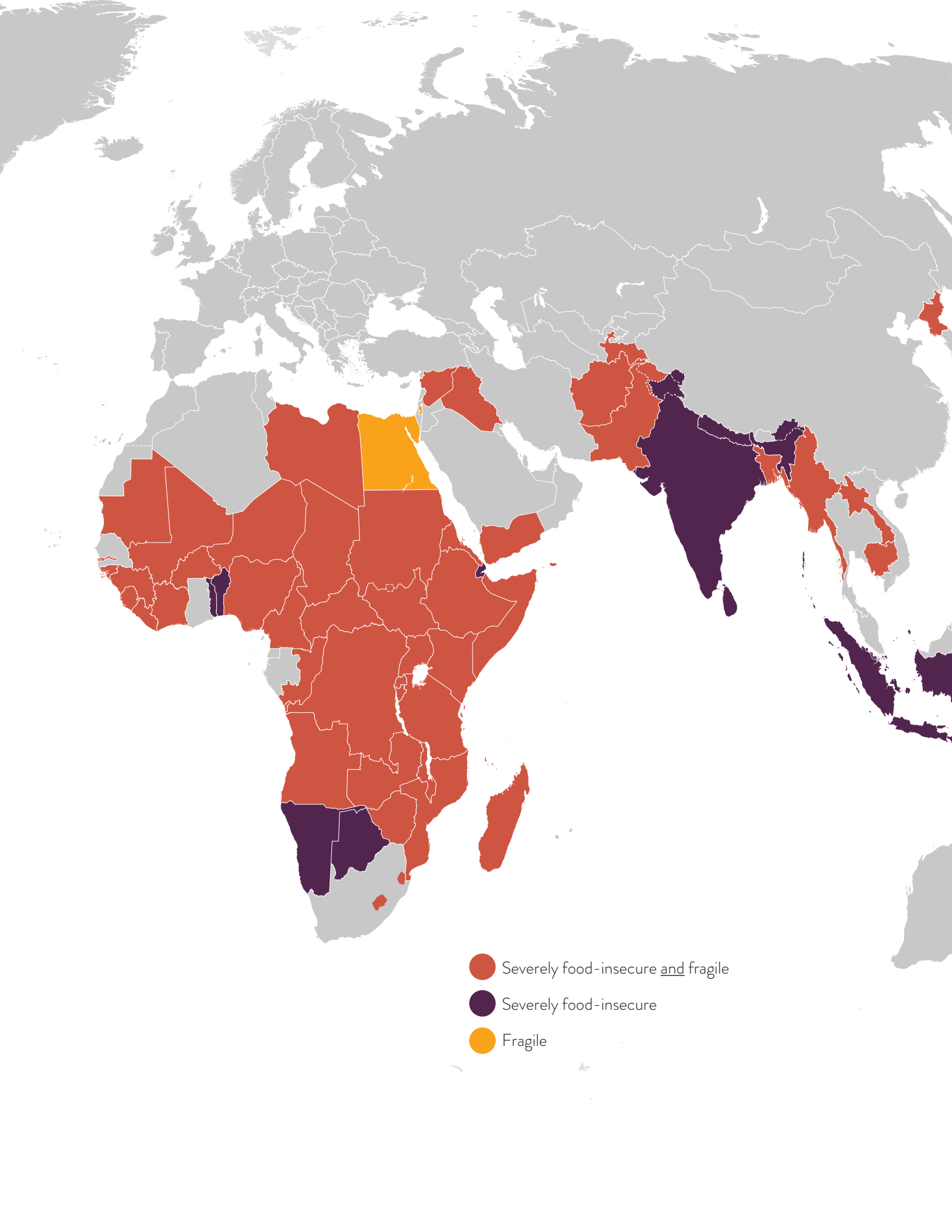
The predominant characteristic of most countries hosting refugees today is that they are low- and middle-income countries that are the least equipped to cope with such an influx. Uganda, one of the smallest countries in sub-Saharan Africa, is hosting more than 1 million refugees from South Sudan and other neighboring countries. Meanwhile, Lebanon, a middle-income country, is hosting more than 1 million Syrian refugees, representing 20 percent of the country's population of 4.5 million. These countries are providing a global public good, yet face considerable challenges in meeting the immediate needs of their own citizens.

Figure 1. Food Insecurity and Fragility

Food insecurity and fragility are mutually reinforcing—food insecurity produces instability and instability produces food insecurity. This map identifies states listed on two separate indices: (1) the IFPRI Global Hunger Index (GHI); and (2) the OECD Fragility Index. Included among GHI countries are those states experiencing "significant concern", "serious" "alarming" or "extremely alarming" levels of food insecurity. Fragile states include those countries listed as "fragile" or "extremely fragile" according to the OECD's analysis. Of the 64 countries on these combined lists, 51 (~80%) are considered both severely food insecure and fragile.

(See Annex 3 for a full list of countries and their rankings)




Severely food-insecure and fragile
Severely food-insecure
Fragile

Increased migration and the spilling of conflicts beyond borders have led to a proliferation of, and interest in, "fragile states"—states defined by "the absence or breakdown of a social contract between people and their government. Fragile states suffer from deficits of institutional capacity and political legitimacy that increase the risk of instability and violent conflict and sap the state of its resilience to disruptive shocks" (Burns, Flournoy et al. 2016). By 2030, between half and two-thirds of the world's poor are expected to live in states classified as fragile. While a decade ago most fragile states were low-income countries, today almost half are middle-income countries. Of the 53 countries listed with "serious, alarming or extremely alarming" levels of food insecurity on the 2015 Global Hunger Index, all but three (Benin, Botswana and Namibia) were also listed as "fragile", according to global indices (Simmons 2017). Drawing on these same datasets, in 2016 approximately 80 percent of countries that are considered severely food-insecure are also listed as "fragile" or "extremely fragile" (Figure 1).

Meanwhile, the United Nations estimates that approximately 1.3 billion people in the world also live on ecologically fragile land (UNDP 2015). While the defining challenge facing the humanitarian system today is the proliferation of violent conflict, each year some 22.5 million people are displaced by climate-related extreme events, in part because of inadequate early warning systems (or inadequate responses), a lack of safety net protection systems, or insufficient investments in resilience-building and disaster risk reduction. It is estimated that climate change could force as many as 122 million people into poverty by 2030 (FAO 2016). In fact, 80 percent of the world's hungry live in places that are prone to natural disasters and environmental degradation.

Despite the current environment, tools to fight global hunger and the instability it produces have never been more effective. While hunger still affects one out of every nine people on the planet, it was not long ago that the world's hungry numbered over 1 billion. Over the last 20 years, more than 200 million people have been lifted out of hunger, and a total of 72 out of 129 developing countries had succeeded in halving the rates of hunger by 2015 (FAO, IFAD et al. 2015). In short, we have the tools to fight global hunger and instability. The questions remains: Do we have sufficient political will to dedicate the necessary resources, financial or otherwise?

1.b The evolving U.S. development-security nexus

Today's humanitarian crisis occurs within an evolving international system characterized by increased interconnectivity of markets and the proliferation of new modes of communication. The traditional interstate conflicts of the First and Second World Wars faded and gave way to the ideological exchanges of the Cold War. The Cold War period was characterized by local proxy battles over the nature of economies and the state's role in them. Meanwhile, in the

last half of the 20th century, increasing population and consumption pressures combined with globalization and expansion of market liberalism, giving rise to resource-based conflicts that have often devolved into intra-state ethnic battles. In modern times, domestic conflicts and civil wars are far more common than interstate violence (Urdal 2005).

Entering into the new Millennia, a new trend is emerging. The nation-state—which has reigned sovereign in the international system since the 17th century—has further surrendered its exclusive position as the main belligerent in war. Today, non-state actors, often motivated by extremist ideologies and facilitated by improved recruiting capability, have occupied a larger space in the international system. According to recent reports, non-state conflicts have increased by 125 percent since 2010, and now represent the single largest category of conflict today (FAO et al. 2017). Many of the major challenges to U.S. global security interests today result primarily from intra-state conflicts in fragile states where non-state actors play a large role. Syria, Iraq, Afghanistan, Libya, and Yemen are significant examples of these security challenges.

A main "weapon" of modern conflict is information, allowing non-state actors to undermine traditional nation states in more consequential ways, attacking their legitimacy rather than their military power (Cheng 2010). Consequently, "it is now widely acknowledged that purely military responses to terrorism are likely to fail, and that a successful precaution against it requires a well-developed policy response... (Mepham 2002)" (in Feridun & Sezgin 2008 p. 226). Moreover, "one of the most effective actions in fighting terrorism is to identify the factors that are related to the formation of terrorism and to determine the conditions that enable terrorist groups to operate and find support for their activities" (ibid, p. 226). The state of the world today forces us to consider non-traditional security threats, including food insecurity.

The U.S. national security apparatus has evolved to meet this changing landscape, increasingly utilizing non-traditional and non-military measures, including elevating development activities within its national security portfolio. The 2010 Presidential Policy Directive on Global Development, for example, formally promoted development to a central U.S. foreign policy pillar equal to diplomacy and defense. With this action, the U.S. Agency for International Development (USAID)

> "America has two fundamental powers. One is the power of inspiration. The other is the power of intimidation. Those of us in uniform are in an intimidating role up against the enemy. But we now fight wars among innocent people, among populations that need to be on our side if we're going to win. There is where America's power of inspiration comes to bear."
>
> - U.S. Secretary of Defense James Mattis, Former Commander of U.S. Central Command, 2013

administrator participated regularly in National Security Council meetings. 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" (Stavridis and Brigety II 2012 p. 53).

While only recently formalized in U.S. policy, the role of development in promoting U.S. national security interests has long been recognized by the national intelligence, defense and diplomatic communities. In 2010, then Secretary of Defense Robert Gates noted that "to truly harness the 'full strength of America'...requires having civilian institutions of diplomacy and development that are adequately staffed and properly funded." Perhaps the most widely cited development-security reference is attributable to the current Secretary of Defense, General James Mattis. In Congressional testimony in 2013, in his capacity as Commander of U.S. Central Command, the General remarked, "If you don't fund the State Department fully, then I need to buy more ammunition." This sentiment is clearly shared by the broader military community. In February 2017, over 121 generals signed a letter to Congressional leaders urging them to maintain funding for diplomacy and foreign aid: "We know from our service in uniform that many of the crises our nation faces do not have military solutions alone... the military will lead the fight against terrorism on the battlefield, but it needs strong civilian partners in the battle against the drivers of extremism—lack of opportunity, insecurity, injustice and hopelessness."

Food security has historically formed the foundation of this development-security nexus. The Food and Agriculture Organization of the United Nations, for example, was born in a time of war. In a now renowned memorandum, "Draft Memorandum on a United Nations Program for Freedom From Want of Food," Frank L. McDougall outlined a proposal for what would become the first international organization dedicated to hunger alleviation. The original working title of that memorandum was: "Progress in the War of Ideas." The memorandum begins by stating, "the purpose of the United Nations is first to win the war and then to win the peace. " Embroiled in the heart of the Second World War, world leaders decided that food security deserved their attention and that the battle over hearts and minds begins with the stomach.

Today, the food-security nexus has become common parlance in the U.S. foreign policy community. As Senator Pat Roberts (R-KS.) wrote in 2015: "Show me a nation that cannot feed itself, and I'll show you a nation in chaos." The failure to respond adequately to drought conditions, for example, is widely accepted as a contributing factor to political regime change in Ethiopia both in the 1970s and the 1980s. More recently, food price riots contributed to the toppling of governments in Haiti and Madagascar in 2007 and 2008 and violent protest in at least 40 other countries worldwide. Production shocks and prices spikes in 2011 were

similarly linked to the social unrest of the Arab Spring, and the ongoing Syrian crisis has clear links to prolonged, historic drought conditions affecting food supplies. Meanwhile, Darfur has been branded the "first climate change conflict" by many observers. Today, countries experiencing anti-Western insurgent movements are regularly the top recipients of food assistance. While this is, in part, geopolitically motivated, in today's international systems these crises also tend to be the most chronic and prolonged conflicts. In other words, responding disproportionally to these crises does not constitute a tradeoff between security concerns and meeting the needs of the world's most vulnerable—they are often one and the same.

As stated by former WFP Executive Director, Josette Sheeran, in 2009, "food security is not only a matter of humanitarian assistance and agricultural development; it is a matter of national security, peace and stability. Without food, people starve, migrate or revolt, as we have seen during the food crisis last year when 30 countries saw riots as people protested when families could no longer afford food. " In a recent National Intelligence Council assessment, the agency writes that, "in some countries, declining food security will almost certainly contribute to social disruptions or large-scale political instability or conflict" (2015 p. i). On March 15th, 2017 a bipartisan group of thirty U.S. Senators sent a signed letter to White House Office of Management and Budget Director, Mick Mulvaney, regarding proposed cuts to U.S. food assistance programs. They stated in no uncertain terms "a strong commitment from the U.S. to strengthen global food security is not only necessary to alleviate hunger and suffering, but also to create a safer and more secure world. "

The tangible commitment to development—and food security specifically—as a pillar of U.S. national security is demonstrated by a bipartisan commitment by the U.S. Congress and the Executive Branch to alleviate global hunger. U.S. food security programming has grown increasingly comprehensive in recent years, focusing on emergency food assistance, agricultural development, nutrition and safety nets. Today, the U.S. is the world's largest provider of both in-kind and cash-based emergency food assistance. Investments in the agricultural sector through the Feed the Future initiative—especially for small-scale subsistence farmers—have had deep impact in reducing extreme poverty and hunger with positive spillover effects into the wider economy. Importantly, the global leadership and financial commitments made by the U.S. at the G8 Summit in L'Aquila in 2009 that made Feed the Future possible led to increased agricultural funding from other donor nations, totaling $22 billion over a three-year period. Meanwhile, the evidence with respect to the benefits of maternal and childhood nutrition has grown considerably, and safety nets—including food transfers and school meals—are being adopted and deployed widely across the developing world.

2. Setting the stage: methodology and key considerations

Caption: A picture inside of Al Saeed Center for Culture and Science, the central library in Taiz city in Yemen, following its burning and destruction during the fighting between armed groups.
Credit: WFP/Ahmed Basha

Despite the increased attention paid to the link between food insecurity and instability and the growing catalogue of quotes from the international affairs community, the relationship is most-often cited anecdotally. This is because while the link between food insecurity and instability is highly intuitive, it is difficult to measure in practice.[1] Food insecurity is intimately related to other forms and causes of poverty. Yet these challenges can be overcome through robustness checking and control variables. These, as well as relevant qualitative checks, are increasingly available in the last five years as more studies have been produced in the food-related instability space (Figure 2).

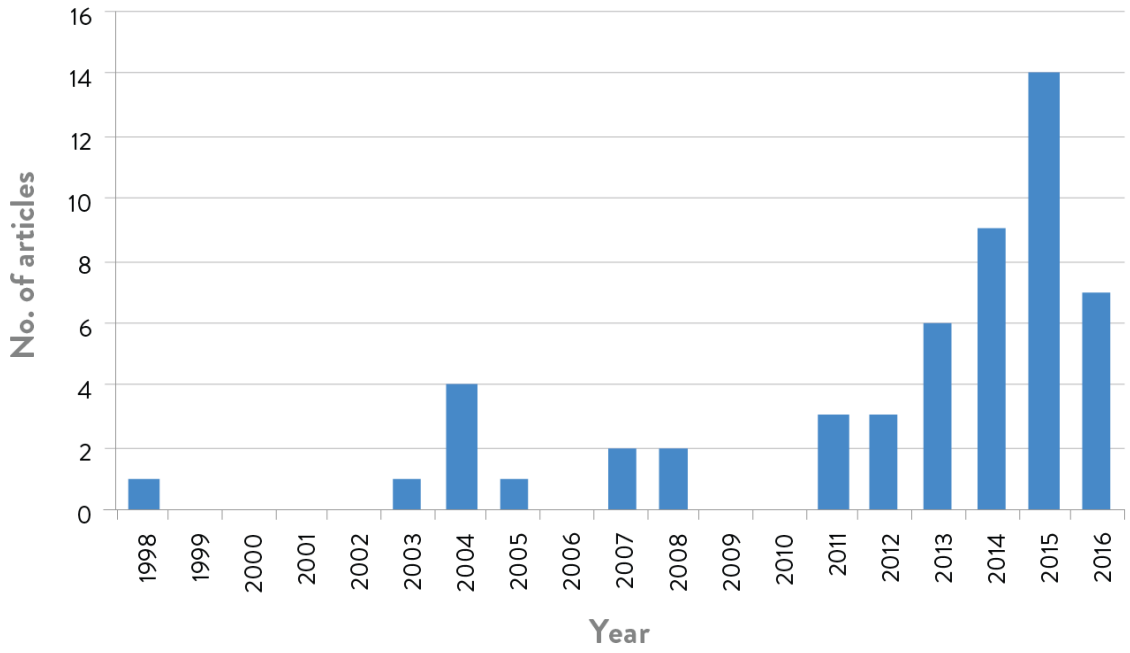
In an effort to surface this relatively new body of literature and to remedy the apparent lack of empirical evidence between food insecurity and instability, this report approaches the relationship in a systematic way. Specifically, the Web of Science academic database was queried—containing 90 million peer-reviewed journal articles—to exhaustively catalogue the relevant literature. Our word search combinations (see Annex 2) yielded 3,000 articles with varying degrees of proximity to the desired topic. This sample was reduced to 564 priority articles describing the relationship in both directions (i.e. instability causing food insecurity and food insecurity leading to instability), and 53 high-priority articles that explicitly test the relationship between food insecurity and instability. The results of this review demonstrate that 77 percent (41 of 53) of high-priority studies determine food insecurity and instability to be positively correlated, 17 percent (9 of 53) partially correlated, and 6 percent (3 of 53) without correlation[2] (see Annex 1). While this literature sample does not represent the entire universe of academic work, it does constitute among the most expansive studies on the relationship to date.

> "...to truly harness the 'full strength of America' ... requires having civilian institutions of diplomacy and development that are adequately staffed and properly funded."
>
> - Secretary of Defense Robert Gates, 2010

1 For quantitative studies exploring the food-instability nexus, demonstrating causation and establishing an appropriate statistical relationship between independent (food insecurity) and dependent (instability) variables is plagued by two factors: co-determination and reverse causation. Co-determination occurs when an uncontrolled or "confounding" variable affects both independent and dependent variables (i.e. where poverty produces both food insecurity and conflict independently). Reverse causation, meanwhile, occurs in the context of a 'causal loop' where the dependent variable acts on the independent variable (i.e. where conflict is both caused by, and produces, food insecurity). Food-related instability is especially susceptible to both of these methodological complications.

2 Although the vast majority of studies in this sample are quantitative in nature and utilize statistical modeling and regression to arrive at correlation, several do not. "Correlation", as used here, refers broadly to general agreement on the positive relationship between food insecurity and conflict as determined through a variety of methods.

Figure 2. Annual distribution of food-related instability articles in sample (n=53)



Source: Authors

Note: In the sample produced through this review, the literature on food-related instability has seen a proliferation in the last five years. Almost 75 percent of articles published on the topic (n=39) were produced in the period between 2012 and 2016. This recent work lends improved empirical evidence to the link between food insecurity and conflict. In particular, these studies have served to widen the geographic distribution of analyses, introduce new control variables and qualitative checks, and ultimately to improve our understanding of the conditions mediating the relationship between food insecurity and instability.

These high-level findings should be taken with appropriate caution and alongside the detail provided in the forthcoming sections. To be sure, the relationship between food insecurity and instability is contextually dependent and mutually reinforcing—there are as many caveats as articles in this sample. Contributing to this complexity, there are many forms and drivers of food insecurity and an equally complicated spectrum of instability. From the 53 articles examined in detail, for example, 11 unique drivers of food insecurity were identified, linked to at least nine separate types of instability ranging from peaceful protest to interstate conflict, with riots and civil war in between (Figure 3).

Given this complexity, throughout the text the term "food-related instability"is used to refer to the totality of interactions between food insecurity and instability as demonstrated in the

literature. This inherent complexity and nuance led one author to appropriately title their work on this topic as "The devil is in the details: investigation of the relationships between conflict, food price and climate across Africa" (Raleigh, Choi et al. 2015).

Defining key terms

Food insecurity takes many forms. Today, 815 million people around the world are undernourished. Among the many faces of hunger are the 65 million people displaced by conflict, persecution and violence worldwide. Nearly half of the world's hungry are farmers themselves, not growing enough to adequately feed their families. The hungry are the one in four children worldwide suffering from malnutrition, responsible for almost half of all deaths of children under five. And the hungry are those experiencing economic shocks and unforeseen tragedies that threaten to unravel their lives. Food security is often considered through four central elements: Availability, access, utilization, and stability. To capture this wide range of food insecurity drivers, the following widely accepted definition of food security is used:

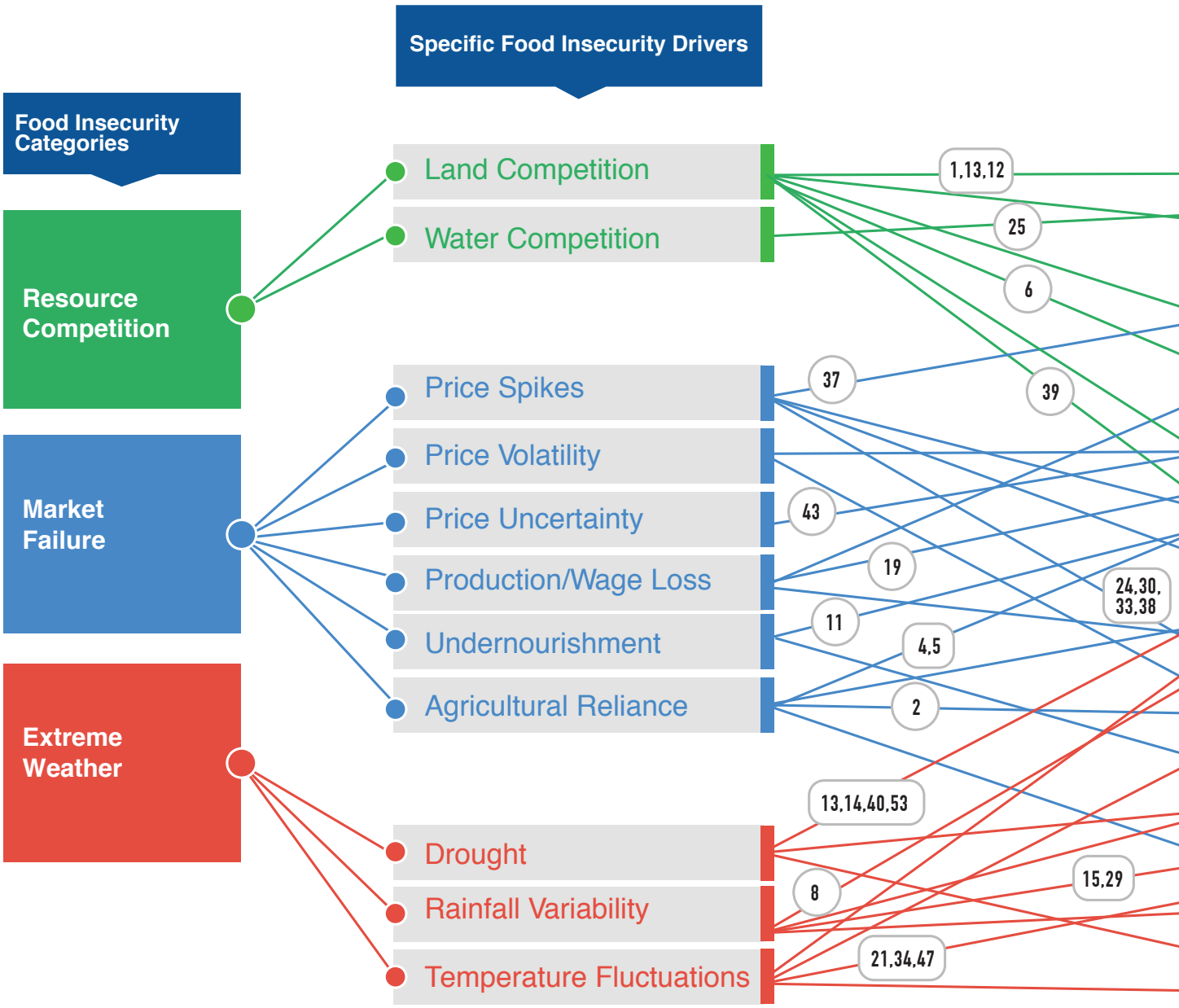
> **Food Security:** Availability and adequate access at all times to sufficient, safe, nutritious food to maintain a healthy and active life.

Similarly, "instability" refers to a variety of socio-political conditions ranging from peaceful protest to global war. Instances on this spectrum can have very precise or loose definitions. Civil war, for example, is often defined as conflicts where "(i) at least one of the parties involved is the government; (ii) there is some harm inflicted on the stronger forces (at least 5 percent of the fatalities by the weaker forces); and (iii) there are at least 1,000 battle-related deaths." Barrett, meanwhile, defines instability far more ambiguously, as "the absence of coordinated human activities that cause widespread disruptions of daily life for local populations" (2013 p. 8). In this definition, not all instability is bad. Riots and protests that remain non-violent can often lead to meaningful social change. So as to not constrict our understanding of this complicated relationship, the following definition of instability is used:

> **Food related-instability**: The totality of interactions between food insecurity and social unrest, ranging from peaceful protest to interstate conflict.

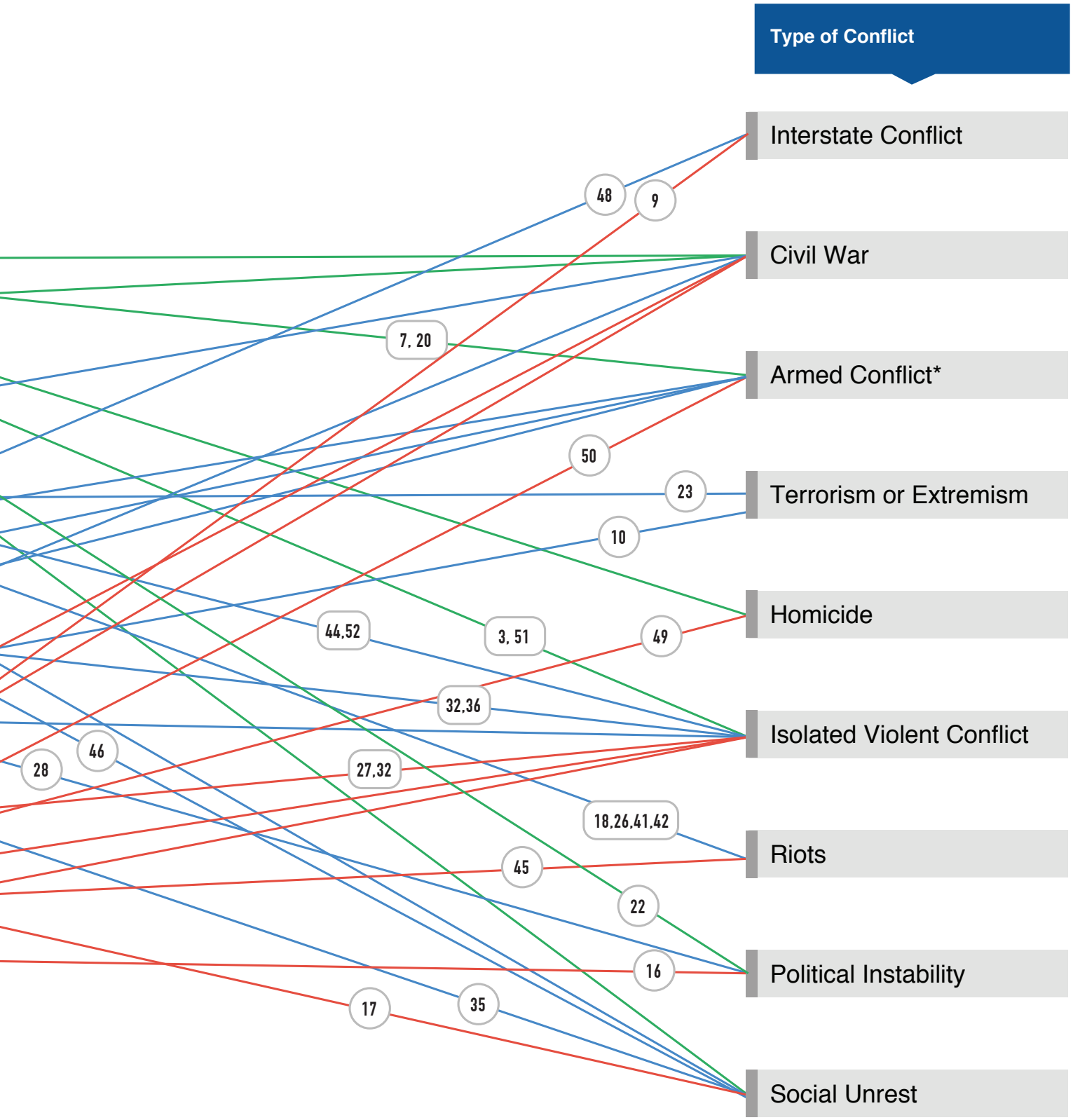
Beyond these definitional issues, at the outset of this report it is also important to emphasize another critical point: Conflict is almost never driven by a single cause. Disasters are often considered to be "natural" or "man-made," and slow or rapid onset. Yet some authors have noted that, in the modern international system, distinguishing between natural or manmade

Figure 3. Visualization of the food-instability relationship in academic literature (n=53)



Source: Authors
Note: The food-instability relationship is complex, context-dependent, and mutually reinforcing. This is due, in part, to the many definitions of instability utilized in academic studies and the myriad drivers of food insecurity. At least nine separate categories of conflict and eleven specific drivers of food insecurity were identified. Given this complexity, the term "food-related instability" is used to refer to the totality of interactions between food insecurity and instability. The parenthesized numbers on the line connections refer to academic studies listed in Annex 1.

* "Armed Conflict" is a broad category commonly used by authors to refer to conflicts that either do not meet the casualty criteria for "Civil War" (i.e. an average of 1,000 battle deaths a year), or for which the state is not involved as a combatant (i.e. conflict between non-state actors).


Type of Conflict
Interstate Conflict
Civil War
Armed Conflict*
Terrorism or Extremism
Homicide
Isolated Violent Conflict
Riots
Political Instability
Social Unrest
48
9
7, 20
50
23
10
44,52
3, 51
49
32,36
46
28
27,32
18,26,41,42
45
22
16
17
35

crises is increasingly unhelpful. That's because "virtually every contemporary crisis is caused by a combination of factors" (Maxwell 2013 p. 281). What is striking about the modern international system today is how quickly natural disasters can morph into man-made crises, either through the state's failure to intervene or an inappropriate intervention by the state.

As Christopher Barrett notes in his seminal collection of essays, *Food Security & Sociopolitical Stability*, "The translation of food security stressors or shocks into sociopolitical instability is not automatic. That link is mediated by a host of factors associated with the preventive and responsive measures taken by governments, firms, civil society organizations and individuals" (2013, p. 5). In fact, "actions taken in an effort to address food security stressors may have consequences for food security, stability or both…that ultimately matter far more than the direct impacts of biophysical drivers such as climate or land or water scarcity" (ibid, p. 5). Regime type, extent of market participation, policies (e.g. price subsidies, land reform) and history of violent conflict are just several factors that mediate the link between food insecurity and conflict.

In what follows, the main body of this report is organized along the interrelated drivers of food-related instability frequently examined in the literature. Examples range from land and water competition brought on by migratory pressures and forced displacement, food price spikes and production shocks leading to demonstrations and riots, and drought and rainfall fluctuations producing violent civil conflict, among other instances. Before addressing these studies in detail, it is important to discuss the specific motivations for individuals to engage in food-related conflict.

2.a Motivations: grievance, greed or governance

While there has been a proliferation of studies statistically correlating food insecurity with instability (see Section 3 and Annex 1), some authors have argued that the relationship lacks sufficient treatment of the actual mechanisms that transmit shocks into violence (Seter 2016). That is to say, it is one thing to correlate two variables, but it is entirely another to identify the individual rationale for observed human behavior. Understanding the food-security nexus means first answering the fundamental question: Why do food-insecure people resort to violence or other forms of social unrest? In the food-related instability literature, several causal mechanisms are identified, often summarized as "grievance, greed, or polity" motivations (Collier and Hoeffler 2004, Maystadt, Tan et al. 2014). Understanding these motivations—referred to as grievance, economic and governance-based motivations henceforth—is key to implementing appropriate measures to sever the link between food insecurity and instability.

Grievance

According to the grievance theory, poverty and hunger lead people to act out of desperation, motivated by a perceived injustice upon them or another group. "People with nothing to lose," according to one author, "may also be willing to be recruited to execute violent acts if they are convinced that it would contribute to justice for the population group of interest or serve a higher goal, including those promoted by religions and politics" (Pinstrup-Andersen and Shimokawa 2008 p. 513).

The grievance motivation is especially potent when food insecurity provides an impetus for the airing of longstanding societal divisions. Populations, after all, tend to "cleave along pre-established lines" (Taylor 1996 p. 494). Furthermore, especially in protracted conflicts, it is not uncommon for belligerents' rationale for engaging in war to evolve. As noted by von Uexkull, "Individual and local actors take advantage of the war to settle conflicts that have little bearing on the [original] goal of the belligerents" (2014 p. 18). This is sometimes described as the distinction between localized conflict and a driving or "master" cleavage. The importance of pre-existing societal rifts like these explain why the link between food insecurity and instability is often referred to as the "straw that broke the camel's back," "the perfect storm," a "threat multiplier," and other such metaphors.

Grievance-based motivation is not unique to violent conflict; it has been associated with several types of social unrest, violent and non-violent. As will be seen with regard to food price riots (Section 3.b), for example, those groups that commonly participate in demonstrations are often not the most food-insecure. They are, instead, more well-off urbanites, mobilizing based on perceived injustice or a breakdown in the social contract between the state and its people. In this case, grievance is based not on relative deprivation, but unachieved expectations. In other words, hungry people are not always violent, and violent people are not always hungry.

Economic

A second, related motivational theory is economic in nature. Reflecting this commonly held view, U.S. Senator Richard Lugar (R-IN) recently remarked, "Hungry people are desperate people and desperation can sow the seeds of radicalism." Yet food-related instability is not driven purely by desperation; sometimes there is a clear economic advantage to resorting to violence. This motivation is often reduced to a simplified equation: Does engaging in violent conflict or social unrest yield a higher economic and social return than the status quo (i.e. Is there a compelling opportunity cost of inaction)? Economic motivation, in many instances, is a derivative of deprivation and grievance given that extreme poverty provides a low baseline status quo that can be exploited by violent groups.

Poverty and hunger tend to be concentrated in rural subsistence agriculture communities, making the agricultural sector a prime candidate for economic-based motivations for conflict. It is for this reason that most of the evidence base on the link between food insecurity and conflict is concentrated on the developing world. In fact, survey evidence from the war in Sierra Leone (Humphreys and Weinstein 2008) and Rwanda (Verwimp 2005) demonstrate that farming represented the most commonly held pre-war occupation among recruits in those conflicts. Similarly, rainfall shortages in Burundi were found to be associated with a higher rate of rebel recruitment in that conflict (Nillesen and Verwimp 2010).

"Rebels typically use economic selective incentives in order to motivate followers. Besides political indoctrination, coercion, and the use of ethnic vocabularies, rebel groups depend on a minimum of pecuniary rewards—if not wages, then at least food (Herbst 2000, Gates 2002)" (von Uexkull 2014 p. 18). Unemployment and loss of livelihood are, under this theory, potentially major contributors to the onset of violence. Theisen et al. (2011) describe this playing out in the context of the 1984 famine in Ethiopia. "The famine," they state, "clearly made it easier for the [opposition political party] to persuade local Tigrayans to turn against the Amhara-dominated state, and it also lowered the opportunity cost of joining the rebellion by making ordinary life insecure and miserable" (p. 88).

> "We can continue to provide leadership in the world, or we can turn our back on the world's hungry. We can empower our neighbors with the tools to put food on the table, or we can watch our enemies fill those same hands with weapons."
>
> -Former U.S. Senators Bob Dole and Tom Daschle, 2017

While the relationship between food and stability is often considered on a global level, the origins of the relationship are as small as the cells in our bodies. Brain chemistry is, in part, a product of the food we eat. Rational decision-making is dependent first and foremost on the energy we supply our brains. Sufficient caloric intake of the right balance of micro-and macronutrients determines our ability to problem solve, communicate, collaborate with other humans, and make decisions in our best—or our collective best—interest. In other words, food supplies us with the ability to create and sustain peace. Food scarcity, because of the biophysical effects on the human body and mind, can produce just the opposite.

BOX 1

The agricultural economics of rebellion in Somalia

Prior to the famine declaration in South Sudan in 2017, Somalia was the last country to formally face famine, leading to the death of over 250,000 people. In the lead-up to the declaration in July 2011, Somalia experienced one of its worst droughts in over 50 years. In a predominantly agricultural-based economy, drought conditions led to increased resource competition among rural populations and the widespread loss of livelihoods, especially among pastoralist communities common to south-central Somalia. The livestock sector alone contributes to almost half of the country's GDP and provides livelihoods for over 60 percent of the Somali population.

Embroiled in civil conflict since the early 1990s, drought and conflict have been consistent features in the country's political economy. Somalia, some observers have noted, is "a textbook case of an acute emergency superimposed on a protracted crisis" (Maxwell 2013 p. 294). In 2011, the country saw the convergence of persistent drought, ongoing civil war, and a global food price spike that disproportionately impacted Somalia's highly import-dependent food economy. In many ways, Somalia is also a poignant example of food-related economic deprivation that leads to increased recruitment for violent rebellions.

Al-Shabaab, an al-Qaeda affiliate, had been in conflict with the recognized government in Somalia, the Transitional Federal Government (TFG), since 2006 when the country's capital was recaptured by the TFG. Central to al-Shabaab's insurgency strategy was—and remains today—the undermining of the TFG's legitimacy and the recruitment of disenfranchised or impoverished people to its movement. In the lead-up to the famine, al-Shabaab's strategy was two-fold: deny humanitarian access in their controlled territory to limit external influence on local populations; and provide their own economic incentives to build goodwill toward the movement and to support further recruitment.

From August 2010 to June 2011, the year before famine was declared, 78 communications regarding the deteriorating food security situation in the country were released, and over 50 briefings with donors, humanitarian agencies and the media were conducted (Lautze, Bell et al. 2012). These calls were not answered given the lack of humanitarian access to reach vulnerable populations and donor policies that prevented aid delivery. In the U.S., for example, the Office of Foreign Assets Control in the Treasury Department prohibited the delivery of U.S. food assistance in al-Shabaab-controlled areas for fear the aid may be used to support the regime.

While denying access to international humanitarian agencies, al-Shabaab was reported to offer cash-payments or even salaries in exchange for enlistment to its movement. In fact, former militants describe al-Shabaab enlistment as a commercial venture, not an ideological one (Maystadt and Ecker 2014). "This [famine]," noted a United Nations High Commission for Refugees (UNHCR) representative, "has been a boon for al-Shabaab's recruitment campaign because when you don't have purchasing power to buy the food, you will be encouraged to be recruited because then you will be saved, and you can use that salary or you could be given food" (Heilprin 2011). During this same period, USAID administrator Shah noted that al-Qaeda operatives were delivering "food aid" to food-insecure communities in direct competition with Western food assistance, both in Somalia and in Yemen (Essex 2014, FAO 2016).

While al-Shabaab was providing incentives to people within their territory, they were also driven by the logistical necessity of feeding their rebellion, both literally and figuratively. As noted by Hendrix and Brinkman (2013), al-Shabaab resorted to levying taxes and confiscating livestock in order to support its opposition to the TFG. Maxwell also notes that some displaced populations were forced to return home in an effort to reestablish agricultural production within their territory (Maxwell 2013).

In 2017, famine looms yet again in Somalia, with over 6 million people in the country in need of humanitarian assistance. After over 10 years in existence, Al-Shabaab continues to restrict access to those in need, perpetuating the cycle of hunger and violence in the country.

There are various other examples of this "equation" playing out in practice (see Box 2). In Nigeria, for example, Boko Haram pays to recruit members to its movement and economic incentives have been demonstrated to be a stronger driver of recruitment than religious extremism (IEP 2016, Ewi and Salifu 2017). As noted by General Carter Ham, former commander of Africa Command, "If you're a young Muslim man in northeastern Nigeria, and you look at your government and say, my prospects for a job are pretty slim, there's no education or health care, and then suddenly some guy comes along and offers me money, prestige, a gun and a girl, a purpose, that becomes attractive."

Meanwhile, in Colombia, Le Billion (2005) "describes how the FARC guerilla units [...] during the conflict period provided protection on peasant land holdings and guaranteed a minimum price for both cocoa and agricultural productions because peasant productiveness was seen as key to the viability of insurgency" (Fjelde 2015 p. 527). Most recently, as cited by Hendrix (2016), "[Former] WFP Executive Director Ertharin Cousin has alleged that cuts in food aid for Syrian refugees are making young men in neighboring Lebanon "prime targets" for recruitment by the Islamic State [ISIS], and young men in areas under ISIS control often join in order to meet basic needs like food, shelter and protection" (p. 10).

Importantly, it is not always non-state actors that use economic incentives to draw participants into conflict. Hezbollah is also reported to have implemented sizeable welfare assistance programs in an effort to boost recruitment and "win over" local populations (Dobransky 2015). Similarly, the Government of Sudan was reported to have promised land to Arab militia recruits in exchange for fighting in the Darfur rebellion (Brosche and Rothbart 2013). Ultimately, as stated by Shortland et al. (2013) "the literature on war economies argues that prolonged civil wars have an economic logic: certain groups may obtain material gains from committing acts of violence and hence resist peace building efforts" (Abstract). As has been demonstrated, the economics of rebellion is highly nuanced, driven by a combination of macro "victory" incentives as well as complex micro economics that provide a pathway for desperate individuals to engage in violence—even when it runs counter to their values or ideologies.

Governance

A final consideration for the onset of food-related instability is that of governance, or the ability of the state to respond to shocks, provide political inclusivity or to suppress uprising (Maystadt, Tan et al. 2014, Jones, Mattiacci et al. 2017). While governance does not directly account for an individual's motivations, it does frame those motivations in important ways. For example, according to the "crime and punishment" theory (Becker 2007), part of the opportunity cost calculations undertaken by individuals considering engaging in social unrest includes the likelihood of punitive repercussions by the state. When the state's ability to

enforce rule-of-law is diminished or non-existent, it is easier for economic or grievance-motivated individuals to engage in conflict.

As described in the following section, while transitory food insecurity from price spikes often fuel urban unrest, more consequential rebellions or extremist movements tend to take root in predominantly rural areas where more objectively food-insecure and resource-dependent populations are concentrated. The most extreme levels of poverty in the developing world are concentrated among rural populations, in part because of a lack government penetration in rural territories—the precise reason that insurgency tends to also take root in these areas (Fearon and Laitin 2003, Kalyvas 2003, Koren and Bagozzi 2016). As noted by Barrett (2013), "insurgencies typically begin and are fought primarily in the hard-to-police rural countryside and have at least symbolic, and typically substantive, connections to contested real resources" (p. 16). Rural populations also tend to be less educated than their urban counterparts, providing for heightened recruitment opportunities for rebellions.

Moreover, in agricultural-based economies, the food production shocks that initiate rebellion simultaneously reduce the state's ability to respond appropriately. As noted by Fjelde (2015), "Tax revenue from agriculture constitutes a major source of state income in developing countries" (p. 527). In the event of agricultural production loss, "the government is thus restrained in the efforts to cushion the negative effects of local economic shock, making it more difficult for the state to dissuade peasants from supporting a rebellion " (ibid p. 527). In recent work by Jones et al. (2017), the authors find that state vulnerability to food insecurity, or a country's ability to respond to sudden changes in food security, is an even more powerful predictor of violence onset than food insecurity itself. In other words, "capable governance is an even better guarantor of peace than good weather" (Abstract).

The motivations addressed here are further reinforced by interviews conducted by the United Nations Development Programme with 495 individuals that voluntarily joined extremist groups in Africa. The results of their analysis demonstrate that while religious and economic motivators are strong drivers of recruitment, a lack of trust in government (police, politicians or the military) is the single strongest driver, especially when a family or friend is killed or arrested by the government (UNDP 2017). The specific conditions that contribute to grievance or economic motivations and that determine the state's ability to respond (governance) vary extensively between contexts. The conditions are often both determined by the food security stressors at play and serve to determine the type of instability ultimately experienced.

3. Categories of food-related instability

Caption: A picture of cracked earth in Niger. Drought can be devastating for poor farmers and their families.
Credit: WFP/Rein Skullerud

The drivers of conflict are many. Central to accurately representing the food-stability relationship is controlling for these myriad factors. Several authors, for example, have demonstrated that there is a strong negative relationship between gross domestic product (GDP), GDP growth and armed conflict (Collier and Hoeffler 2004, Hegre and Sambanis 2006). Income inequality, meanwhile, has been similarly linked to the onset of conflict (Muller and Seligson 1987, Auvinen and Nafziger 1999, Collier 2000, Collier, Elliott et al. 2003, Miguel, Satyanth et al. 2004, Sambanis 2005, Koch and Cranmer 2007, Harsch 2008, Nel and Righarts 2008, Macours 2011). In fact, Hegre and Sambanis (2006) test 88 variables for their historical impact on the emergence of civil war. They find that several factors prove robust: "Large population and low-income levels, low rates of economic growth, recent political instability and inconsistent democratic institutions, small military establishments and rough terrain, and war-prone and undemocratic neighbors" (Abstract), among others. Importantly, many of these factors are endemic to agricultural–based developing economies.

In what follows in this section, the results from the literature in our sample are presented, organized according to three interrelated categories of drivers of food-related instability: (1) Agricultural resource competition; (2) market failure; and (3) extreme weather events. This information is presented objectively, and, when available, in the precise language of the authors so as to remain true to the original spirit and intent of the studies represented in this review.

3.a Agricultural resource competition

Thomas Malthus, the English philosopher and cleric, long prophesized that food production would not keep pace with population growth, leading to violent conflict based on intense resource competition (1798). It was through war and suffering of this kind that equilibrium would be returned to the global food system. The Green Revolution in the 1960s and 70s successfully staved off Malthus' doomsday scenario on a global scale, but pressures on agricultural resources like land and water result in violent skirmishes and civil unrest still today, especially in the context of unprecedented human displacement. In the last half century, in fact, some 40 percent of civil wars have been linked to natural resource competition (FAO et al. 2017). The literature on the resource competition-instability nexus, as it pertains to agriculture, focuses primarily on land and water availability.

Agricultural resource competition varies considerably between contexts depending on a country's economic reliance on agriculture. Across much of the developing world, and especially sub-Saharan Africa, agriculture constitutes a large percentage of total GDP and employs up to 80 percent of the rural population. The continent has abundant land and water resources, but—like the food supply—it suffers from considerable inter- and intra-state distribution issues (Barrett and Upton 2013). Africa is home to nearly half of the world's

remaining, uncultivated arable land (Deninger and Byerlee 2012). Yet desertification and widespread land degradation pose considerable challenges to full development of lands for agricultural uses. Furthermore, frequent state-led land reform measures to address wealth and capital inequalities, international "land-grabs," and ineffective or non-existent land tenure laws further fuel the likelihood of conflict related to land use and land use change. Meanwhile, in sharp contrast to the abundance of land and water available in Africa, the Middle East and North Africa (MENA) suffers from agricultural resource deficits that prevent countries from meeting their required caloric needs domestically. Given high production costs at home and unfavorable growing conditions, acquisition of arable land on the African continent has been undertaken by many oil and mineral-rich MENA countries. External resource appropriations like this have been associated with conflict in some instances (Ide 2015).

Land

The most widely recognized driver of agricultural resource competition-induced instability is land availability. Food production and agriculture has remained nearly the same for 10,000 years, when humans first domesticated wheat in the Fertile Crescent. While there has been advances in synthetic inputs, hybrid and modified seed varietals, and even laboratory food production, the way in which food is produced today remains intimately linked to the availability of arable land. While cities can expand, rural agricultural-based economies are inherently bound by the availability of land suitable for agriculture.

In our sample, Andre and Platteau (1998) discuss the ways in which localized land conflicts paved the way for broader conflict to occur in Rwanda in the early 1990s. They note that while "extreme scarcity of land resources and lack of non-agricultural employment opportunities did not (directly) cause the civil war… there can be no doubt that the strained situation … goes a long way towards explaining why violence spread so quickly and so devastatingly through the countryside" (p. 38). A study by Webersik (2004) describes a similar effect occurring in Somalia during the same time period, further reinforced by Peters and Richards (2011) in their analysis of the onset of civil war in Sierra Leone.

Meanwhile, Villarreal (2004) explores land distribution in Mexico for its relationship with rural violence. The author finds that higher inequality in land distribution is associated with an increased likelihood of violence, measured by homicide rates. Specifically, a one standard deviation increase in inequality corresponds to a 20 percent increase in the homicide rate in rural Mexico. Meanwhile, in a global study of environmental degradation and demographics, Urdal (2005) determines that, in some instances, cropland scarcity can effectively reduce the likelihood of conflict. However, when cropland scarcity combines with high population growth, there is a marked increase in conflict frequency. Unequal distribution of land as described in these cases has been associated with conflict in Brazil, El Salvador, Guatemala,

Zimbabwe, South Africa, Rwanda, Burundi, Cote d'Ivoire, and Ghana, to name only a few instances (Moore 1966, Kriger 1991, Wickham-Crowley 1991, Firmin-Sellers 2000, Deninger and Castagnini 2006, Simmons, Walker et al. 2007).

Land competition has long manifested in conflicts between pastoral and sedentary communities. Nomadic herders traditionally operate in territory unfit for sedentary agricultural production. Pastoralists rely on their mobility as a coping mechanism against short-term weather and market variations. Yet as long-term climatic conditions deteriorate and lands become further degraded, pastoralists—especially in the African Sahel—are encroaching on agricultural lands where rains are more reliable and temperatures more suitable for livestock production. Developing countries often lack stable institutions that serve to arbitrate these disputes. Widespread drought erodes nomadic adaptation strategies like clan-based support since a large swath of the population is affected simultaneously. This is described by McKune and Silva (2013) among pastoralists in Niger who "are moving further afield in search of grazing land and water, which often means travelling farther south, where average rainfall is slightly higher...in doing so, pastoral communities encroach upon agricultural lands [and] some pastoralists are choosing to sedentarise" (p. 1722). Importantly, the likelihood of land conflicts increases between ethnically diverse communities[3]. This is common to post-colonial Africa (Mwesigye and Matsumoto 2016), but is true across a host of settings. Tubi and Feitelson (2016), for example, examine conflict between Bedouin herders and Jewish farmers in the Mediterranean region. They determine that conflict in this setting is more likely when groups lack previous familiarity with one another.

What has been described thus far is nomadic encroachment on sedentary agriculture, yet the opposite can also prove true in situations where traditional indigenous hunter-gatherer societies are encroached upon by would-be settlers or even private companies (Hitchcock, Sapignoli et al. 2015). Proposed large-scale land acquisitions by Daewoo, for example, led to the toppling of the government in Madagascar in 2009, currently the first example of an agricultural "land grab" contributing directly to political instability (Burnod, Ratsialonana et al. 2013). This phenomenon is likely to continue, however, as the lifestyle of nomadic and semi-nomadic groups collide with state ambitions to pursue modern, sedentary, export-oriented agricultural growth models.

This serves to demonstrate that a major element of the resource competition-conflict nexus is human migration. The relationship between resource competition and migration is mutually reinforcing. Food insecurity has been directly linked to migration in Central America, including Guatemala, El Salvador and Honduras (WFP, IOM et al. 2016). Migration can place new stresses on rural economies and resources, and resource competition can, in turn,

3 Recently, in 2017, armed clashes between Muslim herdsmen and Christian farmers in northern Nigeria claimed more lives than violent extremism associated with Boko Haram: "Although Boko Haram is still a threat, more deaths last year were tied to pastoral conflicts than the extremist group—470 people killed in cattle rustling incidents and 1,425 killed in clashes between farmers and herdsmen." In: Onubogu, O. (2017). "Nigeria's New Threat: Guns, Cows and Clashes Over Land." The Olive Branch. U.S. Institute of Peace.

lead to increased migration (Gleditsch, Wallensteen et al. 2002, Black, Adger et al. 2011, Raleigh 2011, Ghimire, Ferreira et al. 2015). Among the most in-depth studies to date on the cycle of conflict, food insecurity and migration has been recently undertaken by the World Food Programme's (WFP) Vulnerability Analysis and Mapping Unit. Researchers there, using quantitative data and focus group discussions and surveys with migrants from East and West Africa, Asia and the Middle East, have determined that "refugee outflows increased by 0.4 percent for each additional year of conflict, and 1.9 percent for each year of additional food insecurity" (2017 p. 8). The decision to migrate is predicated on the search for tolerable living conditions and physical security. In fact, the report notes that migrants may choose to leave places of temporary refuge if these conditions are not met. The authors note, for example, that nearly half of the Syrian refugees interviewed in Lebanon and Jordan stated that they aimed to move on to another country due to a lack of assistance for their families and insufficient job opportunities.

Land-grab conflicts also serve to highlight that resource competition can result from policy choices as often as it does from natural phenomenon. Agricultural land reform has long been a driver of social unrest and sometimes violence. Land reform can result from policy decisions in peacetime, or from the forced expropriation of lands during times of war or territorial expansion, and even in the context of post-conflict resettlement (Unruh 1993, Boehmer and Sobek 2005). State-centered, socialistic and communistic regimes have historically shared food production as a core feature of a designed economy. From Russia's state-owned collectivized farms to China's centralization of agriculture in the "Great Leap Forward," these regimes have asserted food as a form of social control to implement their ideological visions. In Maoist China, for example, several authors have attributed the rise of widespread famine to the communal system of food production and unrealistic production targets imposed by the regime (Chen 2009, Sun 2010). Similarly, forced collectivization in the Soviet Union was attributed to the death of millions of rural peasants between 1930 and the end of the Second World War. Redistributional land reform has led to social unrest in many settings beyond the Soviet protectorates, including North Korea, Uganda (Adelman and Peterman 2014), South Africa (Dlamini, Verschoor et al. 2013), Zimbabwe (Swarns 2002 and Colart 2002 in Barrett 2013), Cambodia (Diepart and Dupuis 2014), and Guatemala (Bergeret 2016). Hiro and Omori (2015) note the empirical risk of a coup rises considerably when significant policy changes like land reform are introduced.

Water

While land-related conflict dominates the available literature, water is also a critical input for food production and some of the most pervasive conflicts today are driven by water access. Globally, agriculture accounts for more than 70 percent of freshwater withdrawals, and as much as 90 percent in developing countries (FAO 2011). It is estimated that by 2050, more

than half of the world's population will live in water-stressed regions (Chicago Council 2017). Several studies have taken on freshwater availability and its link to violent conflict (Raleigh and Urdal 2007, Gizelis and Wooden 2010). Individual drought events are addressed in the "extreme weather" section of this report. Multi-year droughts in already semi-arid regions that affect freshwater availability and aquifer recharge resources are addressed here. This is most notable in the case of Syria. The country has a long history of conflict over water. In the lead-up to the 2011 civil war, the country experienced "the worst long-term drought and most severe set of crop failures since agricultural civilizations began in the Fertile Crescent many millennia ago" (Gleick 2014 p. 332). While the country had experienced six major drought events in the last century, only one lasted more than a single growing season. In the three-year period from 2006 to 2009, more than one million farmers were affected by crop loss. This long-term drought—combined with government policies on well-water pumping—placed unsustainable pressure on groundwater aquifers. As a consequence, the southwestern city of Dara'a, situated in one of the traditionally fertile areas of Syria, saw a large influx of migrants and was one of the first sites of social unrest in the country in 2011 (Gleick 2014, Kelley, Mohtadi et al. 2015). As noted by Simmons (2017), "farmers abandoned their land and migrated to cities in search of jobs that didn't exist" (p. 3).

An army marches on its stomach: Feeding a rebellion

There is a tendency to intuitively think of social and political unrest resulting from agricultural resource scarcity, but sometimes the opposite proves true (De Soysa 2000, Collier and Hoeffler 2004). Importantly, as stated by Salehayan and Hendrix (2014), "while sporadic social unrest, such as riots and protest, may emerge from conditions of scarcity, sustaining a militant organization requires considerable planning and resources. In other words, even if people have the motive to fight, they also need the capability to do so…" (p. 240). The old adage "an army marches on its stomach" is as true today in modern warfare as it has been in any other time in human history.

Hendrix and Glaser (2007) demonstrate this phenomenon across sub-Saharan Africa where they find that high freshwater availability per capita is associated with the increased likelihood of prolonged conflict. These results are confirmed by Salehyan and Hendrix (2014), demonstrating that a "one (two) standard deviation increase in precipitation anomaly is associated with a 4.3% (8.8%) increase in the number of attacks, a 6.9% (14.2%) increase in the number of deaths associated with those attacks" (p. 247).

Meanwhile, Rohwani et al. (2011) note that conflicts are more likely in areas characterized by higher vegetation density…"hence it is not only rural regions that are at a higher risk of experiencing conflict, but also, and specifically, agricultural ones" (Koren and Bagozzi 2016 p. 1002). This phenomenon is playing out in real time in today's most high-profile civil war: Syria. As noted by Jaafar and Woertz (2016), agriculture has become a major source of

income—and goodwill through food aid distribution—for ISIS in Syria and Iraq. Using satellite data, the authors demonstrate that grain harvests in ISIS-controlled territories in Iraq in the past year are significantly above pre-conflict averages.

The intensity and duration of conflict, then, is partially dependent on the abundance, rather than the scarcity, of resources. This is consistent with economic-based motivations of conflict where resource availability both facilitates conflict and provides victory incentives that factor into an individual's calculations for engaging in violence. That violent conflict in developing countries tends to occur in areas of relative wealth, facilitating the economic motivation, is referred to as the "honey pot effect" (Buhaug, Gleditsch et al. 2011).

BOX 2

Food as a weapon of war: Agri-terrorism

It follows naturally that if agricultural resources are necessary to sustain insurgency then some belligerents would intentionally deny food to competing groups in order to assert further control. To be sure, food has been used as a form of social control and a weapon of war (Macrae and Zwi 1992). In recent years, there has been considerable attention paid to food as a weapon of war, especially as it relates to agri-terrorism or attempts to utilize the global food supply to inflict mass casualties. As noted by one author, "since the events of September 11, 2001, the potential for the food supply to be a target of terrorism can no longer be viewed in hypothetical terms" (Applebaum 2001).

This area of the food-instability relationship has produced a huge amount of interest and writing in the last decade:

Neher 1999,
Franz and Zajtchuk 2000
Applebaum 2001
Dupont 2003
Norton 2003
Applebaum 2004
Cupp, Walker et al. 2004
Fletcher 2004
Hope 2004
Zink 2004
Crutchley, Rodgers et al. 2007
Seebeck 2007
Gullino, Gamliel et al. 2008
Spear 2008
Mohtadi and Murshid 2009
Orehovec and Stipetic 2009
Shmatkov, Oksamitniy et al. 2009
Ancona, Appel et al. 2010
Alpas and Smith 2011
Busta and Kennedy 2011
Mansour 2011
McMillan Johnson et al. 2011
Veiga 2011
Alpas and Kiymaz 2012,
Mohtadi and Agiwal 2012
Onokpise and Louime 2012
Yeh, Seo et al. 2012
Keremidis, Appel et al. 2013
O'Shea 2015

3.b Market failure

The global food price spikes of 2007-2008 and 2011 have increased the profile of one manifestation of food-related instability in particular: Food riots. Between 2000 and 2008, global wheat prices tripled and corn prices doubled (Hanrahan and Reilly 2009), accelerating rapidly in late 2007 and leading to social unrest in at least 40 developing and middle-income countries in what has been termed the "silent tsunami" (Phillips 2014). Food price spikes are widely recognized as leading to regime change in Haiti and Madagascar during this period (Barrett 2013). A second wave of price spikes owing to agricultural commodity production shocks on the Eurasian continent in 2011 has also been linked to the rise of the Arab Spring in the Middle East (Johnstone and Mazo 2011, Sternberg 2012, Lybbert and Morgan 2013, Maystadt, Tan et al. 2014). The relationship was thrust into the media with the dramatic protest of Mohammed Bouazizi, a vegetable vendor in Tunisia whose immolation epitomized the desperation felt by many in the region and served as a catalyst for wider unrest (Lybbert and Morgan 2013). These events have led to a proliferation of studies linking food price spikes with unrest and instability. Yet food price spikes are just one manifestation of market-induced conflict explored in the literature. In our sample, scholars have addressed food-related instability as it manifests in agricultural commodity price changes, agricultural production shocks, overall economic reliance on the agricultural sector and undernourishment resulting from a lack of access to food.

Food price riots are hardly a new phenomenon. Food riots are chronicled by Shakespeare in 16th century England (Cheng 2010) and played a major role in popular uprising during the French Revolution (Bouton 2000). In the last century, food price riots have occurred in Vienna (1911); Berlin (1912); New York (1917), Paris (1919); Germany (1931); Morocco (1980); and Argentina (2001), to name only a few. Food riots are an intuitive result of commodity price fluctuations given the relative economic inelasticity of food—there is no substitute for food, even when prices are high. Some authors suggest that agricultural price shocks differ from other commodities (e.g. oil) in that they predominantly impact the income of individual farmers and families, rather than the state, which owns the majority of profits from extractive natural resource industries (Dube and Vargas 2013). In fact, it has been recently demonstrated that food price shocks have almost twice the impact on economic growth than other commodities, including oil (De Winne and Peersman 2016).

> "The lack of food security contributes to political instability – food was a primary reason people first took to the streets in Tunisia. Food and poverty were right at the top of the list in the squares of Egypt, right next to the call for political freedom. In 2007 to 2008, the last global food crisis, there were major food riots in nearly 40 countries."
>
> - U.S. Congressman Jim McGovern (D-MA), 2011

In examining the 2007-2008 price riots across Sub-Saharan Africa, Berazneva and Lee (2013) explore why riots occurred in some contexts and not in others. They determine that "...higher levels of poverty, restricted access to and availability of food, urbanization, a coastal location, more oppressive regimes and stronger civil societies are associated with a higher likelihood of riots occurring" (Abstract). Specifically, they show that a single point increase in the human poverty index produces a 19-32 percent increase in the likelihood of riot. Smith (2014), meanwhile, determines that a sudden increase in domestic food prices in urban Africa (a one standard deviation increase from the average) in a given month increases the likelihood of social unrest, including riots, by between 64.8 and 78.8 percent. The literature on riots serves to illustrate that responses to food price shocks are not always violent in nature. In exploring the food price shocks in Ethiopia, Alem and Kohlin (2014), for example, explore "dissatisfaction." In their survey, "moving from not affected at all by food price inflation to being affected very negatively increases the probability that one is very dissatisfied by 10.4%" (p. 860).

Among Berazneva and Lee's (2013) central finding is that riots are more likely to occur in urban areas of countries with coastal access and with higher reliance on food imports. These results are partially contested by Natalini et al. (2015) who determine that self-sufficiency in food production (i.e. reliance on imports) does not prove statistically robust in their global analysis. Instead of import reliance, the authors point to broad-based fragility as an indicator of riot onset. Specifically, "the likelihood of experiencing a food riot increases with the increase in fragility...more fragile countries in the first quartile have a 37 percent likelihood of a riot event compared to 18 percent likelihood for the second quartile" (p. 4376-7).

Hendrix and Haggard (2015), examining urban unrest resulting from food price spikes, note that regime type (i.e. democracy versus autocracy) plays an important role in mediating this relationship. Unrest, they determine, is more likely in democracies with "permissive political opportunity structures" that allow for popular uprising and government protest. As a salient example of oppression within autocratic regimes, they note that, "famine in North Korea claimed between 600,000 and 1 million lives during the mid-1990s, but no rioting or demonstrations occurred" (p. 145). While the likelihood of demonstrations and riots is reduced in oppressive regimes, Piazza (2013) notes that the opposite is true for more organized, persistent forms of conflict. In examining the link between consumer price volatility and terrorism between 1970 and 2010, the author finds that the relationship is "most consistently present in nondemocratic and "hybrid" political regimes and in medium human development countries rather than in democracies or in countries characterized by very high or very low economic development" (Abstract). This lends some support to the theory that food price riots and terrorism are driven, in part, by economic motivations combined with the relative inability of the state to impose punitive sanctions.

Fjelde (2015) also explores the impacts of food prices beyond riots and demonstrations,

examining the link between domestic price indices and the onset of violent civil conflict. In contrast to studies in predominantly urban areas, the author finds that a 20 percent drop in price indices (i.e. lower economic returns in the agricultural sector) leads to almost a one percent increase in the likelihood of civil war, also consistent with grievance and economic-based motivations for conflict. This result is further corroborated by Koren and Bagozzi (2016) noting that, "unsupported warring groups on all sides of a conflict may move into regions that offer more access to cropland in order to forage and pillage to support themselves, which in turn produces higher incidences of hostilities, especially if there is not enough food per person available in these fertile regions" (p. 1007).

While many authors have tested the relationship between food prices and conflict, at least one has tested the hypothesis that food price volatility matters more than food prices themselves. Food price volatility, after all, speaks directly to trust in food systems and governments (Bellemare 2015). This relationship does not prove robust, however, with the authors noting that price volatility often works in consumers' favor. O'Trakoun (2015) , takes on a similarly nuanced dimension of food prices: Food price uncertainty. In an analysis from 1966-90, the author finds a positive relationship between the outbreak of intrastate civil conflict and food price uncertainty as measured by variance in global commodity prices combined with a country-specific food producer price index. Finally, Weinberg and Bakker (2015) note that the critical component of the food price-unrest relationship is not the level of the price, but the price change itself, confirming earlier research (Brinkman and Hendrix 2011).

While these statistical correlations between food insecurity and instability are useful (and widespread), Hossain and Kalita (2014) argue that it is even more instructive to examine the "moral economy" to understand why people riot. That is to say, that the likelihood of riots and conflict resulting from food prices spikes is driven, in part, by the perceptions of what produced those spikes in the first instance. They examine these perceptions in Bangladesh, Indonesia, Kenya and Zambia in the wake of the 2007-2008 food price spikes. In these cases, food riots occur based on a perception of certain groups hoarding or profiteering from the price inflation, government corruption and collusion with food suppliers, and the perceived inaction by the government in responding to the needs of vulnerable people, among other drivers.[4]

Finally, there are some scholars who theorize that the kind of food that initiates a riot is also of importance to understanding civil unrest. Foods that tend to have cultural significance, for example, especially those consumed by the rich and the poor alike, are more likely to incite widespread unrest. This why staple products of national significance—e.g. the "pasta riots"

4 That perceptions serve as a powerful driver of food-related instability is captured in the U.S. National Intelligence Council definition of food security: "Perceived and physical access to food supplies sufficient to meet basic needs and preferences at every level—individual, community, state, and global" (NIC 2015).

in Italy or "tortilla riots" in Mexico—often lend their names to social unrest (Bentley 1998). In the Middle East, bread has considerable cultural significance across social strata, meaning the rise in global wheat prices (and high import reliance in MENA) was especially predictive of conflict in this setting. Legwegoh et al. (2015) apply a survey to citizens in Cameroon to determine whether there is a link between food type and the likelihood of riots. They determine that certain foods—roots, eggs, oil and sugar, among them—are especially linked to increased outbreak of instability.

Despite the diverse conditions accounted for above, of all of the food-related instability manifestations, price spikes are perhaps the most prone to oversimplification. In fact, work by Sneyd et al. (2013) in analyzing media treatment of the 2008 food riots demonstrate that Western media coverage contributes to the oversimplification of food riot origins through the narrative that price increases alone contribute to unrest. The reality is far more context-dependent. Two important lessons can be drawn from food price shock literature: (1) Food price riots are a largely urban phenomenon driven by perceived injustice rather than actual chronic food insecurity; and (2) many developing countries are insulated from global food price, limiting the affect of international prices shocks on domestic markets.

Urban Bias

First and foremost, food price riots are an overwhelmingly urban phenomenon. Lybbert and Morgan (2013) examine the links between food insecurity in the MENA region and the origins of the Arab Spring in 2011. They pose an important question that is helpful in understanding the link between food price spikes and riot, mainly: "Were the protesters who took to the streets food-insecure even if they weren't hungry?" (p. 367). Here, the authors are reflecting on the fact that food price riots are predominantly undertaken by relatively well-to-do urban constituents, rather than chronically food-insecure farmers and rural populations. As Legwegoh et al. (2015) state, "The poorest tend to suffer in silence and rarely (if ever) protest the system that is causing their starvation" (p. 14115).

If not by chronic food insecurity, riots in response to transitory food price shocks are predominantly driven by the symbolic importance of price shocks and are enabled by the high density of people living in urban centers with adequate channels of communication that allow for mass organization—this is often referred to as the "contagion effect." Yet one additional condition appears necessary: "The conviction that [food] insecurity threats stem from a fundamental injustice—a sense of being cheated, deceived, betrayed, misled, or otherwise exploited (Lybbert and Morgan 2013 p. 367)."

This is to say that, food price riots are often less to do with the welfare of food-insecure people and more to do with the perceived breakdown in the social contract between a

government and its people. This is why riots tend to occur more frequently in countries with "preexisting political opposition ready and willing to attempt to overthrow the state, by violent means if necessary" (Barrett 2013 p. 13). As summarized by Bush (2010), "the riots may have been triggered by spikes in food prices in 2007-2008, but there were many other factors that underpinned them. Demonstrators challenged injustice, inequality and political repression. Food riots were part of an important groundswell of mobilization that brought together a wide range of political coalitions for change and the promotion of human dignity" (Abstract).

It is unsurprising, then, that efforts to protect food access by urban constituents have been strongly promoted across the developing world. This "urban bias" is driven by population densities, physical proximity to decision makers (i.e. capital cities), and this well-understood ability of urban dwellers to mobilize in popular protest. Protections that favor urban residents include agricultural marketing boards, consumer subsidies and price control, and export restriction, all of which serve to maintain adequate food supply while simultaneously dampening prices. The urban bias is unlikely to change given that urbanization is happening faster in sub-Saharan Africa and South Asia than in the rest of the world. Simultaneously, sub-Saharan Africa has the youngest average population on the planet, and the highest estimated population growth. It is estimated that the continent will host over 1 billion people by 2020. These converging trends, combined with increased cell phone availability and internet access, will place new pressures on urban areas and potentially increase the likelihood of food-related riots.

Market Insulation

That production shortages in one part of the world can affect social and political instability in another is what Sternberg refers to as the "globalization of drought" (2012 p. 523). Globalization provides a similar "transmission mechanism" for temperature variations and other natural and man-made crises (Bollfrass and Shaver 2015). Sternberg chronicles this phenomenon in the context of the Arab Spring, noting that crop loss and export restrictions in China created the conditions for uprising in Egypt in 2011. In an increasingly globalized food system, actions taken by governments to alleviate their own domestic food insecurity—like reduced import tariffs and export restrictions and other market distortions—can inadvertently undermine the stability of other nations (Barrett 2013).

Yet studies that link international food price spikes with the occurrence of domestic civil unrest in developing countries—especially in sub-Saharan Africa—are sometimes "based on the false assumption that changes in international commodity prices are directly reflected in domestic prices" (Smith 2014 p. 682). Many developing countries lack access to international markets or implement price controls to protect against global commodity price fluctuations. As noted by Weignberg and Bakker, as a result of these measures, "since

1970, over 50 developed and developing countries have experienced one or more years in which government policies yielded domestic food prices below international market prices (Anderson 2010)" (2015 p. 316). In fact, in the direct aftermath of the 2007-2008 food price crisis, 31 pecent of 105 surveyed countries put in place export restrictions and half reduced food import taxes (Sharma 2011). Given these interventions, the link between international and local prices is not automatic—it varies between countries and regions.

As a salient example, the 20 most populous countries in sub-Saharan Africa are net importers of grain (Hendrix 2016). This explains why widespread price-related unrest was experienced across the continent while almost no large-scale crop failure was reported in sub-Saharan Africa in 2008 (Legwegoh, Fraser et al. 2015). Still, almost 90 percent of food requirements in Africa are met domestically (Hendrix 2016). Both food imports and exports remain low across sub-Saharan Africa, due in part to the fact that the continent is home to 17 land-locked countries. The MENA region, meanwhile, imports over half of the food it consumes, the highest import dependency on the planet (Lybbert and Morgan 2013). According to an analysis conducted by Breisinger et al. (2010), every country in the MENA region is expected to increase its reliance on cereal imports over the next decade. In some instances over others, global markets have penetrated domestic economies, subjecting local populations to the volatility of global markets.

Market insulation, while effectively buffering developing countries against price volatility, can potentially limit the benefits of globalization and market liberalization. As Hendrix (2016) notes, when local crops fail, countries rely on international markets to effectively redistribute global food stocks. U.S. food commodity exports to sub-Saharan Africa have increased by 200 percent in just the last decade, more than twice the growth rate of exports to developed economies (USDA 2013). International market access can serve to smooth irregularities in local food markets. As stated by Maxwell (2013), "Globalization of markets likely serves to reduce the impact of localized production shocks—at least for net food purchasers." Increasingly integrated global markets have also allowed for innovation in humanitarian assistance like cash and voucher-based transfers of food that draw on local and regional food supplies (ibid).

Ultimately, the link between food price shocks and conflict is dependent upon the country, the perceived reason for the price increase, the agricultural commodity, the type of producer (e.g. large-scale, small-scale, pastoralists, subsistence, etc.), the model of government, and the level of pre-existing social grievance, among other considerations. Even so, while the conditions that determine the relationship between food prices and stability are complex, the dynamic is not devoid of causation. When the globalization of crises meets with burgeoning urbanization and the contagion affect facilitated by widespread access to mass communication, the potential for conflict rises considerably.

Other market-related drivers of instability

Price spikes and price volatility are not the only manifestation of food-related instability driven by economic factors. Several authors link economic dependency on agriculture more broadly to the likelihood of conflict, although these results are mixed (Ross 2004, Ross 2004, Bretthauer 2015). In a study of the drivers of terrorism in Turkey, Feridun and Sezgin (2008), for example, determine that agricultural GDP is an important factor in determining the likelihood of terrorist activity in the country. Specifically, they suggest that while "... total GDP is helpful in explaining terrorism in Turkey... agriculture and government services are more important components of GDP in explaining terrorism than factors such as trade, construction, manufacturing and transportation" (p. 229). The authors call for further investment in agricultural development as a key counter-terrorism strategy. Meanwhile, in a study on agriculture wages and conflict in Colombia, Dube and Vargas (2013) note that a fall in coffee prices—and thus in average on-farm wages from cash crops—had a measurable impact on conflict in affected municipalities. A nearly 70 percent fall in prices between 1997 and 2003 resulted in "18 percent more guerilla attacks, 31 percent more paramilitary attacks, 22 percent more clashes, and 14 percent more casualties in the average coffee municipality" (p. 1385). The presence of cash crops and extractable wealth has also been linked to conflict in Uganda (Deininger 2003). Finally, in a relatively under-researched theme in food-related instability related to food market accessibility and utilization, Pinstrup-Andersen and Shimokawa (2008) demonstrate, using global data from 1980 to 2005, that a "five percentage point decrease in under-five child malnutrition contributes to decreasing the likelihood [of armed conflict] by 1.0-3.5 percentage points" (p. 519).

Of all of the factors that mediate the relationship between food and conflict, economy stands among the most influential. Our understanding of the conditions characterizing this relationship has grown considerably in recent years owing to the availability of higher resolution data that allows us to control for different conditions. Authors are using sub-national and local data on food prices (as well as monthly as opposed to annual data), for example. Simultaneously, conflict databases have become reliable and more nuanced in their treatment of different types of conflict.

3.c Extreme weather events

Food price spikes and agricultural resource competition described above are often driven by short-term variations in weather and climate, the third broad category of food-related instability explored here. Since 2010, the United States has recognized climate change as a "threat-multiplier" in its National Security Strategy and Quadrennial Defense Review. Recently, the Center for Climate Security released a report on "epicenters of climate and

security." They cite 12 critical areas where climate change threatens global security, including the increased frequency of pandemics, disrupted maritime trade routes and displacement and migration, among others (Werrell and Femia 2017).

The last five years have seen a dramatic increase in the number of climate-conflict studies. The results of these analyses have been decidedly mixed, owing to the myriad intervening factors between climate impacts and conflict (Buhaug, Benjaminsen et al. 2015). Authors writing on the extreme weather-conflict relationship are particularly conscious of this "distance" and the limitations of statistical correlation. Increasingly, statistical analyses linking extreme weather events to violent conflict use measures of agricultural productivity as an "intermediary variable" in what is sometimes referred to as two-stage statistical analyses.

Agriculture is an obvious interlocutor between climate and conflict given that the sector is strongly affected by climatological conditions like rainfall variations and temperature fluctuations. Agriculture in the developing world is characterized by reliance on rainfed agricultural production. In fact, it is estimated that 80 percent of agricultural production in developing countries does not employ any form of irrigation (Wani et al. 2009). Furthermore, the impacts of climate change will be most severe in low-latitude countries in tropical, equatorial environments, disproportionately affecting the Global South. While the literature on climate and conflict is vast, included in this section are only those studies explicitly utilizing agriculture as an intermediary between temperature or rainfall variability and instability.

Temperature

In a study of historical temperature fluctuations and instability over the past 500 years, Zhang et al. (2007) determine that periods of cooling are associated with reduced global agricultural productivity and the increased likelihood of war. These results are replicated by Lee (2013) who analyzes temperature fluctuations associated with the North Atlantic Oscillation for their impact on conflict in Europe over a period of five centuries. Dell et al. (2012), in a far more limited and recent time period, successfully link temperature increases with political instability in developing countries. Specifically, the authors note that "an additional 1°C in poor countries is associated with a 2.7 percentage point increase in the probability of change in [political system]" and "a 1°C rise of temperature raises the probability of leader transitions by 3.1 percentage points" (p. 86). These results are corroborated by Su et al. (2016) in a study of ancient China, demonstrating that abnormally warm periods correlate with increased incidences of conflict between farmers and nomadic groups. In the temperature-conflict literature, a clear distinction in geographical contexts is visible: Industrial economies located in higher latitudes are affected more negatively by cooler temperatures while developing countries—where crops are grown dangerously close to plant biophysical heat limits—are more likely to experience conflict in the context of temperature increases.

While the relationship between temperature and conflict is widely validated, Bollfrass and Shaver (2015) question agriculture's role as the primary intermediary. The results of their global analysis demonstrate that while a 20°F rise in temperature is associated with an approximate 2 percent increase in the likelihood of deadly conflict, this relationship proves true even in places without arable cropland. The authors note that this is likely a case of co-determination brought on by impact of heat increases on both crop loss and general human irritability, which has been previously linked to increases in violence. Similarly, the agricultural productivity or income intermediary is not always necessary to prove correlation between rainfall and conflict. Sarsons (2015) studies the effects of rainfall on the onset of conflict while controlling for access to irrigation. Interestingly, rainfall decreases in dam-fed districts is still predictive of riots, even though rainfall impacts on agriculture are mitigated through access to irrigation. The author suggests that riot spillover and migration from nearby rain-fed district and demographic features of dam-fed districts may contribute to this counterintuitive finding. Ultimately, these studies emphasize the need for higher-resolution, sub-national studies on the climate-agriculture-instability relationship.

Rainfall

Drought is also very often associated with instability in the developing world in our sample. Maystadt and Ecker (2014), for example, explore drought conditions in Somalia for its effect on livestock-related conflicts. Using local weather data, authors find that a single standard deviation increase in drought intensity from the average increases conflict likelihood by over 60 percent in that setting.[5] In a broader study across the entire sub-Saharan African region, von Uexkull (2014) finds a similarly positive relationship between drought and conflict, especially in areas dominated by rain-fed agriculture. Also on the African continent, Raleigh et al. (2015) demonstrate that a one standard deviation decrease in average rainfall results in food price increases of around 10 percent within two to three months of the event. This, in turn, produces at least one more measurable conflict event in the same period. Meanwhile, drawing on data sets from colonial Nigeria, Papaioannou (2016) demonstrates that one standard deviation in rainfall variability is associated with an increased homicide rate of approximately 60 people in the affected time period and area. Finally, von Uexkull (2016) finds that drought conditions in developing countries can lead to sustained violence and government opposition, especially in agriculturally-dependent communities characterized by low levels of political inclusivity.

5 In a recent study across 138 developing countries between 1995 and 2008, Bagozzi et al. (2017) determine that an extreme drought event is associated with a 41% increase in the expected number of atrocities committed by rebel groups. According to their model, a "Rebel's strategy of expropriating the civilians' arable land for the purpose of consumption, and the civilian's strategy of defending their land, leads to a 'contest' over the latter's agricultural property" (p. 5).

BOX 3

The first climate change conflict: Sudan and South Sudan

On February 20, 2017, famine was declared in South Sudan, the world's youngest nation. The combined effects of civil war and drought have left nearly 5 million people food-insecure in the country, representing over 40 percent of the population. WFP Country Director Joyce Luma said in 2016 that South Sudan was experiencing a "deadly blend of conflict, economic hardship and poor rains" (UN, 2016).

Conflict is not a new phenomenon in Sudan and South Sudan—it has been ongoing for close to 40 years, causing millions of civilian deaths over that period. Long-running tensions in the era following British colonial occupation between the Arab-Islamic central government in Khartoum and the predominantly non-Arab south in Sudan led to one of the longest civil wars in African history. First from 1955 to 1972, and then again from 1983 to 2005, conflict between the North and South of the country has persisted, culminating in the Comprehensive Peace Agreement that led to South Sudan's independence vote in 2011.

The War in Darfur, parallel to the broader Sudanese Civil War and isolated to the western-most region of Sudan, is still ongoing and represents a microcosm of the ethno-religious tensions playing out the in country. Darfur captured international headlines when U.S. Secretary of State Colin Powell declared in 2004 that genocide was occurring in Sudan in testimony to the U.S. Senate. Sudanese President Omar Al Bashir, along with six others, was later indicted by the International Criminal Court for genocide and crimes against humanity.

Darfur has been labeled the "first climate change conflict" by many observers, given the convergence of environmental and political factors leading to conflict. Sudan and the Darfur region is home to diverse ecological zones, ranging from arid deserts in the north to semi-tropical environments in the south. In the decades leading up to the 2003 outbreak of war, the Sahel region of northern Sudan had witnessed the Sahara Desert advance southward by almost a mile each year and a decrease in annual median rainfall of 15 to 30 percent (UNEP 2007).

These long-term climatic trends have had significant consequences for Sudan's two predominant—and sometimes competing—agricultural systems: Smallholder farmers relying on rain-fed production and nomadic pastoralists. Agriculturalists in Sudan are predominantly ethno-African, while pastoralists are disproportionately of Arab ethnicity. Fast-moving desertification and drought slowly eroded the availability of natural resources to support livelihoods and the peaceful coexistence of these two groups in the region. Longstanding pasture and grazing corridors in Sudan began to shrink at a speed that traditional communal land tenure systems could not arbitrate.

These factors led then U.N. Secretary General Ban Ki-moon to comment in 2007, "Almost invariably, we discuss Darfur in a convenient military and political shorthand—an ethnic conflict pitting Arab militias against black rebels and farmers. Look to its roots, though, and you discover a more complex dynamic. Amid the diverse social and political causes, the Darfur conflict began as an ecological crisis, arising at least in part from climate change." The origins of the War in Darfur and the Sudanese Civil War are multiple and complicated, entho-religious and environmental.

Today, in South Sudan, these same tensions are playing out. After independence, now lacking the unifying power of the independence movement, political, and later ethnic, discord began to surface. Tensions rose, and in 2013 an epidemic of violence remerged in southern Sudan. These events coincided with a major drought event in 2015-2016 in South Sudan and the Horn of Africa. The United Nations Environmental Programme (UNEP) indicates that mean temperatures are likely to increase across Sudan and South Sudan in the coming decades, and yields for major crops like sorghum may fall by as much as 70 percent in that same period. The cycle of conflict and drought will continue.

Like the results from the temperature-instability nexus, authors exploring rainfall variability and conflict caution on the need for a more complete assessment of intervening factors. Theisen et al. (2011), for example, explore drought-related conflict in agriculturally-dependent communities. They find that, although the link between drought and conflict does not prove statistically robust, a "possible counterargument is that a drought could further weaken marginalized groups, thereby constituting a temporary obstacle to mobilization" (p. 89) and "although drought does not seem to increase the short-term risk of civil war, it may affect its dynamics" (p. 104). This is consistent with the literature on the economic and logistical requirements of sustained opposition. Verhoeven cautions against the oversimplification of the climate-instability link in the case of Sudan. The author notes that although Darfur has been labeled as "the first climate change conflict," this moniker fails to account for the socio-political factors that intervene between environmental shocks and the outbreak of conflict. Similarly, in an analysis of drought-induced conflict in Mali, Benjaminsen et al. (2012) determine that factors other than drought—mainly agricultural encroachment on pastoralists' territory (see Section 3.b above)—were more likely initiators of violence in that context.

Ultimately, the extreme weather-instability relationship will continue to evolve as climate impacts worsen. As one author notes, "the rate and extent of past warming and drying will increase manifold in coming decades, so we cannot use historical data to project future trends" (Theisen et al. 2011, p. 105). Our ability to model climate and agricultural systems also continues to improve. Global and Regional Circulation Models of the Earth's terrestrial and ocean systems, for example, are available at higher spatial resolutions today and the global inventory of meteorological stations continues to expand. In fact, authors have noted that the link between extreme weather and instability can be crop-dependent and demonstrated only through sub-national, high-resolution studies that utilize this improved data. After demonstrating a relationship between minimum temperature increase, rice production and conflict in Indonesia, for example, Caruso et al. (2016) note, "Studies concentrating on several countries with different crops and using variations of average temperature as a measure of climate change missed the biological mechanism behind the relationship between climate change and violence" (Abstract). The climate-agriculture-instability relationship is, at least to some extent, crop-dependent.

> "...we know from our service in uniform that many of the crises our nation faces do not have military solutions alone... it needs strong civilian partners in the battle against the drivers of extremism– lack of opportunity, insecurity, injustice, and hopelessness."
>
> - 121 retired Generals of the U.S. Global Leadership Coalition, 2017

4. Development in reverse: how conflict creates food insecurity

Caption: A woman sits at one of several new camps for internally displaced persons (IDPs) at one of the major gateways to Mogadishu, Somalia.
Credit: WFP/Kabir Dhanji

The relationship between hunger and instability is complex, multi-faceted, and best understood as the sum of its many parts. While food-related instability is subject to many individual conditions, the weight of the collective evidence is unmistakable: Food insecurity is empirically linked to instability. In the past five years, in particular, there has been a proliferation of academic articles seeking to correlate these two concepts. With each study, the body of evidence has grown and our understanding of the linkages has improved. In the previous section it was demonstrated how land and water competition, combined with ineffectual government policies to govern these resources, have long led to conflict in the agricultural sector, especially between pastoralists and sedentary groups but increasingly due to more widespread human migration. The globalization of extreme events due to increased market integration and communication (i.e. the contagion effect) has also driven considerable social unrest, primarily in the form of food price riots by urbanites, but also in more persistent, violent forms of revolt that take root in rural areas. Finally, the role of extreme weather events in conflict was examined, noting that although causation in this space is methodologically challenging, both temperature and rainfall variations have been unequivocally linked to food-related instability, especially in developing countries. In these studies, a wide range of food insecurity drivers encompassing availability, access, utilization and stability components of food security (however, utilization—including mal- and undernourishment—does appear to be a relatively under-researched theme in food-related instability) were identified, as well as diverse manifestations of social unrest. This section describes the mutually reinforcing relationship between food insecurity and instability important to modern-day humanitarian crises.

Conflict and food insecurity

"War", as Paul Collier states, “is development in reverse.” That war, instability and violence adversely affect food security is widely documented, and that conflict breeds poverty and vice versa is often referred to as the “conflict trap.” In the words of Green (1993), “in the absence of war even a very poor state can mount programs averting mass migration and famine” (Abstract). This has led some scholars, including Nobel Laureate Amartya Sen, to assert that all famines are political. This conflict-food insecurity direction of causation—while not the main subject of this report—is critically important to understanding the protracted nature of today’s global crises. Conflict, for example, is common to each of the four potential famine situations today in Yemen, Somalia, South Sudan and northeast Nigeria (see Box 4). In fact, civil conflict is the main driving factor in nine of the 10 worst humanitarian crises today (FSIN 2017). Here, we briefly explore the economic and social ramifications of conflict, as well as the critical issue of humanitarian access in conflict situations.

BOX 4

Conflict and famine

In 2017, it is estimated that 20 million people are facing famine across South Sudan, Yemen, Somalia, and northeast Nigeria. Famine, as defined by the Integrated Food Security Phase Classification system, occurs when 20 percent of the population experiences extreme food shortages; at least 30 percent of children under age five suffer from acute malnutrition; and the death rate has doubled, or two per 10,000 people are dying every day.

According to the Famine Early Warning Systems Network (FEWSNET), the most important driver of food insecurity in 2017 is persistent conflict, disrupting livelihoods and trade across regions. With the exception of Somalia, which faces looming famine as a result of both conflict and three consecutive years of drought, the other three countries face worsening food insecurity primarily as a byproduct of internal civil strife. In August 2017, the United Nations Security Council adopted a statement formally acknowledging the link between conflict and famine—the first product adopted by the Security Council in its history related to famine.

South Sudan, the world's youngest country, has endured almost three years of ethnic violence that has destroyed local markets and community assets. Fighting between Yemen's armed forces and Houthi rebels has continued into its second year, causing widespread food and fuel shortages. And an eight-year insurgency by terrorist group Boko Haram in Nigeria has made the northeast region of the country unsafe and at times inaccessible to humanitarian aid.

"Almost all famines, at least in our modern era, are manmade," said World Food Programme spokesperson Challiss McDonough, who was in Somalia during the last declared famine in 2011. "Fundamentally, conflict is at the root of it, and that conflict has led to massive displacement. Millions of people have fled their homes, leaving behind their crops, their livestock, their jobs. Even if they have jobs, the economy is in collapse and the food prices have gone through the roof. So even people who have an income still struggle to be able to buy the food that they need."

Civil war in Yemen began in 2015 and has sporadically closed key ports through which ships deliver humanitarian relief. Government salaries have been slashed, reducing family income as food prices soar. The most vulnerable households have had little choice but to drastically reduce how much and how often they eat. The result is that more than 17 million people—2 in 3 people—do not know where their next meal is coming from.

In Nigeria, Boko Haram's campaign of terrorism has led to one of the most acute humanitarian crises in the world. As of October 2017, 1.62 million people have been displaced in northeast Nigeria, where food insecurity has reached extreme levels. At least 50,000 people in Nigeria are experiencing "famine-like" conditions. In early 2017 rapid response teams from WFP and UNICEF could not reach an estimated 100,000 people in the region due to insecurity.

In the most recent global assessment of food insecurity, a joint group of UN agencies report that of the 815 million people suffering from hunger, almost 500 million are located in countries affected by conflict. In these places, warring parties often ignore their obligations to International Humanitarian Law to protect civilians and allow the passage of humanitarian assistance. The longer that conflict endures, the greater the risk to food insecurity.

First, the loss of productive assets and reduced risk-taking that occur in times of conflict have long-term effects on the re-establishment of agricultural production and the broader economy in war-affected areas. In a study between 1970 and 1997, FAO determined that the value of agricultural output lost due to violent conflict in developing countries totaled $ 121 billion—far more than the value of food assistance received during the same period (2000). Conflict also has the effect of inflating the costs associated with agriculture because of "risk premiums" that affect transport and storage costs (Barrett and Upton 2013). War and conflict have been associated with the increased selling of productive assets like livestock that serve to slow economic recovery in peacetime, as well as other negative coping strategies (Verpoorten 2009, Kimani-Murage, Schofield et al. 2014).

Conflict also prevents the deployment of new agricultural technologies and sustainable land management strategies, increasing the likelihood of future food-related instability (Korf 2003, Nwilene, Nwanze et al. 2008, George 2009, Groninger and Lasko 2011). In a study of terrorism in India, for example, Singh (2013) finds that conflict negatively affects long-term investment in agriculture and suppresses average annual income by at least 4 percent. Mwesigye and Matsumoto (2016) note that agricultural yields fall by 22 percent in the context of ongoing land conflict in Uganda. Meanwhile, in Afghanistan, Groninger and Pense chronicle how agricultural development personnel were explicitly targeted by insurgent groups (2013). Finally, several authors explore the environmental impacts of warfare that can have long-term impacts on the re-establishment of agriculture (Ibaba 2009, Tariku, Van Meirvenne et al. 2010, Stevens, Campbell et al. 2011).

> "There is a close relationship between hunger and conflict, and there is also a close relationship between food security and peace. Hunger leads to conflict and conflict exacerbates hunger."
>
> - FAO Director-General José Graziano da Silva, 2014

Second, conflict can have long-term social and human welfare impacts that also serve to perpetuate greater instability. It has been demonstrated, for example, that even medium-sized conflicts (2,500 battle deaths) increase undernourishment in affected areas by over 3 percent, reduce life expectancy by one year, lead to a 10 percent increase in infant mortality, and deprive an additional 1.8 percent of the population from access to potable water (Gates, Hegre et al. 2012). In post-conflict Ethiopia in 1992, Kinfu found that 59 percent of children in the country were exposed to long-term or chronic undernutrition (1999). Ultimately, food insecurity resulting from conflict has been linked to a host of physical and psychological conditions (many intergenerational), including depression (Patel, Lund et al. 2010, Bertoni 2015, Sun, Knowles et al. 2016, Siefert, Heflin et al. 2004, Whitaker, Phillips et al. 2006, Kleinhaus, Harlap et al. 2013), cancer (Vin-Raviv, Barchana et al. 2012), diabetes and hypertension (Lumey, Stein et al. 2011, Bercovich, Keinan-Boker et al. 2014) and the

increased likelihood of violent behavior later in life (Chilton, Rabinowich et al. 2014, Crandall 2014, Akresh 2016).

Finally, ongoing conflict often prevents humanitarian agencies from reaching the food-insecure, preventing early warning from translating into early action. In Somalia in 2011, for example, al-shabaab expelled aid agencies from their territory in the south of the country in the lead up to the famine. From August 2010 to June 2011, the year before famine was declared, 78 communications regarding the deteriorating food security situation in country were released and more than 50 briefings with donors, NGOs and media conducted (Lautze, Bell et al. 2012). Inaccessibility and policy decisions—not a lack of information or resources—led to the deaths of more than 260,000 people. In Yemen, cranes in the Red Sea port of Hodeidah were damaged by a Houthis airstrike in 2015, preventing the delivery of humanitarian food relief and commercial supplies to the country. In 2017, replacement cranes for the port remained in storage in Dubai because of the risk of renewed targeting and of fueling the Iran-backed Houthis rebellion. Recent work by the World Food Programme demonstrates that because of conflict and instability, the cost of providing humanitarian food assistance to all countries in 2016 was $2.2 billion more than it would have otherwise been (WFP 2017).

5. Food fights back: Severing the link between food insecurity and instability

Caption: Farmer Hellen Atiir takes part in a Food for Assets project that is helping her agricultural community benefit from a new irrigation system in northwestern Kenya.
Credit: WFP/Rein Skullerud

Despite the many circumstances highlighted above linking food insecurity to instability, what is striking is the sheer number of food-related crises that do not erupt into violent conflict. As noted by Theisen et al. "there is a tendency to ignore or underestimate the large number of false positives (i.e., occurrences of drought without conflict [for example])" (2011 p. 104). The reason that food related shocks do not devolve into social unrest is dependent, in part, on certain macro-economic conditions (e.g. availability of strategic grain reserves, export bans, food subsidies etc.) but also on a commitment to comprehensive food security programming. Since the drivers of food insecurity and conflict are many—ranging from calorie availability to more structural issues around land tenure and livelihood opportunities—disrupting the link between food insecurity and conflict requires a diverse toolbox of integrated actions. Fortunately, many of these tools already exist within the overall U.S. Government foreign assistance strategy. They include programs like Food for Peace (P.L. 480, or Title II), the Emergency Food Security Program (EFSP), Feed the Future, and the McGovern-Dole school meals program, among others.

The elements of a comprehensive approach to global food security can be divided into the following four integrated categories: Emergency food assistance, agricultural development, nutrition interventions and safety net systems. These are the four pillars of the 2008 Roadmap to End Global Hunger, a comprehensive food security strategy endorsed by over 50 civil society and business organizations in the United States. The Roadmap served as a platform for engagement with the U.S. Administration and provided the basis for several early attempts to pass comprehensive global food security legislation in Congress. This legislative effort culminated in the 2016 Global Food Security Act (GFSA), formally authorizing cash-based food assistance through EFSP as well as the Feed the Future funding stream. The GFSA called for the creation of a comprehensive plan for U.S. government global food security programming, drawing expertise from 11 diverse federal agencies. Each of these programs and areas of intervention outlined below serve to address at least one of the motivating factors for food-related instability. Namely, they serve to increase the health and well being of affected populations (grievance motivation); provide long-term economic opportunity (economic motivation); and build reliable social protections that can be deployed in times of need, elevating trust in government and building social capital (governance motivation).

5.a Emergency food assistance

Emergency food assistance is among the most effective tools in addressing both grievance and economic-based motivations for instability. In a given year, the United States provides almost $1.5 billion worth of agricultural commodities and $1 billion in cash for emergency food assistance efforts in over 50 countries, administered through Title II and EFSP. This represents approximately 30 percent of all contributions to the World Food Programme,

for example, the top recipient of U.S. food assistance. When provided early, with proper market analysis and in collaboration with local actors, food assistance can serve as a last line of defense between vulnerable people and starvation, meeting basic needs and undermining the conditions for recruitment by non-state actors. In some instances, food assistance has also been successfully deployed as a means to entice combatants to lay down their arms and reintegrate into society (Brinkman and Hendrix 2011).

In emergency situations where markets are functioning and can meet the food demands of affected populations, cash-based transfers—in the form of vouchers and debit cards for the local purchase of food—can expedite the delivery of food assistance to the most vulnerable, effectively responding to grievances before they metastasize into widespread unrest. Cash-based assistance has the added value of bolstering local markets, reducing food transportation and storage costs and providing increased autonomy and dignity among food assistance recipients who experience greater choice in what they purchase from local markets—an important element of food assistance for displaced people that have lost everything. The procurement of food assistance from smallholder farmers (i.e. Farm to Market Alliance) further serves to bolster local markets and provide livelihood support. When markets have adequate capacity, cash-based assistance can be especially effective in the event of sudden-onset disasters like earthquakes and tsunamis, or when existing conflicts escalate in unexpected ways, leading to human displacement.

Cash-based food assistance has led to innovations like electronic vouchers (e-cards) and biometric payment and distribution systems that further improve the efficiency and accountability of emergency food assistance. In Lebanon, for example, the World Food Programme, with support from USAID, is supporting Syrian refugees through the use of e-cards. The debit-cards are pre-loaded with cash, can be recharged—or downloaded—monthly and are available to use at over 450 shops in local markets that have adopted the payment system, simultaneously increasing local capacities to adopt credit and debit card payments more widely. These efforts respond to the changing, protracted nature of regional conflicts and the increased demands this places on middle-income countries with well-established markets hosting refugees. To date, WFP has injected, through e-cards, almost $2 billion in to the local economies of front-line refugee-hosting countries affected by the Syrian crisis.

In-kind food aid in the form of U.S. commodities, in-turn, is a critical resource for hungry people when markets are not functioning, or when there is insufficient capacity in local and regional markets to meet increased demand. This can be especially effective in instances where regional food supplies are diminished due to long term drought conditions, or where conflict has led to market collapse. Whereas cash-based assistance can increase food prices by creating new local demand in food-stressed and crisis-affected markets, in-kind

food aid adds to the supply of food available in an emergency without causing price spikes. In-kind food aid also helps to ensure that populations affected by hunger receive the types of nutritious food necessary to meet their needs, which local markets cannot always accommodate. Critical to the effectiveness of emergency food assistance is proper market analysis to determine the most appropriate delivery modality (i.e. cash versus commodity) and to achieve the desired effect on price stabilization (Brinkman and Hendrix 2011).

> "Show me a nation that cannot feed itself, and I'll show you a nation in chaos."
>
> - U.S. Senator Pat Roberts (R-KS), Chairman of the Senate Agriculture Committee

Emergency food assistance has also benefitted greatly from advancements in and the proliferation of early warning systems. Early warning systems like FEWSNET, WFP's Vulnerability Analysis and Mapping (VAM) Unit, and the global Integrated Phase Classification, allow humanitarian partners to project and respond in real time to potential emergencies. FEWSNET and VAM for example, issued warnings regarding potential famine conditions in South Sudan, Somalia, northeast Nigeria and Yemen as early as January 2017, allowing the international humanitarian community sufficient time to organize and raise awareness and funds to respond. After all, a declaration of famine means that people are already dying from hunger and related causes. By the time famine was declared in Somalia in 2011, for example, more than half of the eventual 260,000 victims had already died. Without the capacity to forecast food insecurity—and when early warning is not adequately met with early action—the cost of humanitarian intervention is much greater, both in dollars and lives lost. The most cost-effective way to respond to famine is prevent it from happening in the first place.

BOX 5

The "new normal" of protracted humanitarian crises

In recent years, the world has seen a dramatic increase in protracted conflict and displacement. Global forced displacement, already at the highest levels since World War II, continues to increase. By the end of 2015, more than 65 million people worldwide had been forced to flee their homes as a result of conflict, persecution, and violence. Adapting to this "new normal" of protracted manmade crises, humanitarian emergencies have increasingly been defined by three key features: (1) Increasing funding deficits; (2) the dual burden facing low and middle income countries hosting refugees; (3) and the prolonged nature of humanitarian emergencies.

First, while donor nations have stepped-up their support in recent years, increasing resource deficits are the product of humanitarian needs growing at a faster pace than donor funding. In 2016 the global humanitarian appeal— the annual assessment of global funding requirements to address the immediate needs resulting from extreme events around the world—was funded at 52 percent, with $11.8 of $22.9 billion provided by donors. The 2016 funding gap of $10.7 billion is larger than the entire 2012 humanitarian appeal. Meanwhile, the number of people who are acutely food insecure in the world rose from 80 million in 2016 to 108 million in 2017—a 35 percent increase in a single year. In this same year, the United Nations released its largest-ever global humanitarian appeal, seeking support for 92.8 million people in 33 countries. For emergency food assistance to be effective, we must ensure a higher level of multi-year funding that is more predictable and flexible and that meets immediate global humanitarian needs.

Second, countries hosting refugees—often middle-income and developing countries themselves—are on the frontlines and under tremendous strain to meet the needs of those seeking assistance while also addressing the basic needs of their own populations. By the end of 2015, the 10 countries hosting the largest numbers of refugees were in developing regions. Five of these were in sub-Saharan Africa. Increased private sector investment in job creation is required—as well as an expansion of bilateral and multilateral financial institution support to middle income countries—to drive economic growth and create jobs for refugees and host-country populations. This will support livelihood creation and promotion of self-reliance, reducing prolonged dependency on external assistance. These countries must be seen as providing a global public good.

Finally, the average length of displacement for refugees has grown to 17 years and the numbers of refugees repatriating has declined to the lowest level in over 30 years. Despite the protracted nature of many of the world's conflict-related crises, humanitarian assistance has been focused primarily on immediate life-saving activities. Still, it is clear that assistance can no longer be framed with a short-term lens alone. We must ensure greater coherence of emergency and development efforts to strengthen local capacity to address recurring and protracted crises through investments in areas such as preparedness, disaster risk reduction and strengthening resilience to future shocks.

Given the complex, mutually reinforcing relationship between food insecurity and conflict, a comprehensive approach to food security programming that effectively severs the link between food insecurity and conflict must take into account these trends affecting the global humanitarian and development regime.

5.b Agricultural development

Food assistance alone will not prevent conflict or the re-emergence of conflict once peace has been achieved. The path toward enduring peace and stability must be locally owned and built on a foundation of economic development and governance and institution-building (Maier 2010). As noted by Collier et al. (2003), almost 40 percent of all post conflict countries eventually relapse into conflict. The permanence of post conflict recovery, according to some authors, can be enhanced with the prioritization of economic development interventions (Maier 2010, Brinkman and Hendrix 2011). Agricultural development is especially important in addressing economic-based motivations for conflict, given the sector's large contribution to developing country economies and its high vulnerability to extreme events. In fact, it has been demonstrated that GDP growth in the agricultural sector is more than twice as effective at reducing poverty than growth in competing sectors in developing countries (World Bank 2008). That is to say, agricultural development, for its outsized effect on economic growth, can be especially effective at deterring recruitment for violent uprisings and delivering peace dividends. According to the World Banks' World Development Indicators, in the last 20 years, agricultural production has almost doubled in low and middle-income countries, yet average yields remain a fraction of what they do in industrialized economies.

Feed the Future, the flagship agricultural development program of the U.S., was designed to methodically increase the productivity of smallholder farmers—the majority of whom are women—and improve their access to agricultural markets, working within existing government development plans to ensure domestic ownership and responsibility. Almost half of the world's hungry—almost 400 million people—are subsistence farmers. Feed the Future has widened the scope of interventions in these countries to encompass the entire agricultural value chain and concentrated these efforts in promising areas for agricultural growth in order to maximize the positive impact of U.S. assistance. Feed the Future recognizes that agriculture is about more than just farming—it is marketing, processing, distribution, food utilization, and a host of other activities. That's why, in addition to increasing productivity through new technologies and management practices, the program focuses on establishing public-private partnerships, ensuring the availability of agricultural credit, organizing farmers and producer organizations, bolstering commodity exchange markets, and creating new agri-business enterprises.

In 2015, Feed the Future reached over 9 million farmers with new technologies and management practices, increasing farmers' incomes by $830 million across all of its target countries. In the area of market expansion and trade, in the past year the program assisted in the development of over 1,500 public-private partnerships, and coordinated loan access for over 1.2 million small and medium sized agro-industries. The total value of agricultural and rural loans accessed through Future the Future support reached almost $900 million

in 2015. These investments have spurred considerable peripheral private sector investment totaling over $150 million. Increased productivity and market access has contributed to significant poverty reduction across Feed the Future participating countries. In Malawi, poverty—relative to baseline assessments—has fallen by 18 percent since the program's inception. In Cambodia, poverty has fallen by 26 percent (USAID 2015, USAID 2016). Ultimately, Feed the Future reinforces the fact that investment in agriculture can be a source of broad-based economic growth, contributing to significant reductions in poverty and food insecurity and, ultimately, decreasing need for international aid.

Agricultural development must be paired with adequate early warning systems and resilience-building that help farmers anticipate and react to temperature variations, rainfall variability and extreme weather events. U.S. leadership in the Global Alliance for Action for Drought Resilience and Growth in the Horn of Africa is an example of bringing together national governments, development partners and other key stakeholders in joint resilience planning to prevent food security crises from escalating. The Global Alliance promotes the coordination of these diverse actors around country-led plans to elevate the importance of resilience building within development strategies. These preventative measures—the establishment of a National Drought Management Authority in Kenya, for example—make sound economic sense: It is estimated that every dollar invested in reducing vulnerability can reduce economic losses from disaster events by as much as seven dollars (UNDP 2012).

5.c Nutrition

Influenced greatly by the 2008 and 2013 *The Lancet* academic journal series on Maternal and Child Undernutrition, global nutrition interventions have increasingly focused on child and maternal health. Nutrition in the first 1,000 days from conception to a child's second birthday can have lifetime impacts on health and prosperity. Lacking proper nutrition in this critical window, physical growth—height, weight and brain development—can be permanently damaged, leading to a diminished capacity to learn and a greater susceptibility to infection. Studies have shown that children who receive proper nutrition in the this first 1,000 days are ten times more likely to survive life-threatening illnesses (Save the Children 2012), attend almost five more grades of schooling than their malnourished peers, earn 20 percent more in wages as adults, and can increase a country's GDP by over 10 percent annually (Bread for the World 2016). Importantly, there is a deep evidence base linking early health risks like

> "...a strong commitment from the U.S. to strengthen global food security is not only necessary to alleviate hunger and suffering, but also to create a safer and more secure world".
>
> - 30 U.S. Senators on U.S. food assistance programs, 2017

malnutrition to the increased likelihood of children adopting aggressive, criminal or violent behavior later in life (Liu 2011). For its effect on both grievance and economic motivations for food-related conflict, interventions that address childhood malnutrition are critical to severing the food insecurity-conflict linkage and avoiding the "conflict trap."

It is estimated that undernutrition reduces global GDP by $1.4 -$2.1 trillion each year. In South Asia and Africa alone, malnutrition contributes to an 11 percent loss in GDP annually. Yet these losses are entirely preventable. Research demonstrates that every $1 spent preventing malnutrition yields $16 in immediate and downstream benefits (IFPRI 2016). In some studies, the rate of return on nutrition spending is as high as $138 when lifelong health and productivity benefits are considered (InterAction 2013). The recent global nutrition investment framework estimates that scaling-up even a limited set of highly cost-effective interventions like micronutrient and vitamin supplementation and staple food fortification, for example, would require $2.2 billion additional annual spending worldwide (World Bank 2016). These interventions are especially crucial given that over 50 percent of today's refugees from conflict, violence and persecution are under the age of 18 (OECD 2016).

5.d Safety net systems

Among the most effective interventions in severing the link between food insecurity and conflict is social protection. Over the last few years, increasing attention has been paid to the importance of safety net programs as a mechanism to address chronic, cyclical or individualized threats to food security. Safety nets directed at food security commonly include conditional and unconditional cash or food transfer programs, food-for-work initiatives, and school meals programs—the most widespread type of safety net. Safety nets protect against societal shocks while providing a poverty floor that prevents the depletion of the productive assets of vulnerable populations. Effective safety net systems can provide a ladder out of impoverishment, breaking the cycle of hunger and extreme poverty and providing an "exit strategy" for global humanitarian organizations and donors. Today, while safety nets extend to 1.9 billion people worldwide, they reach only one quarter of the extreme poor and many countries require support to develop comprehensive safety net systems (World Bank 2015). In fact, almost 75 percent of the world's population lacks reliable access to safety nets. This is especially true in rural areas were chronic forms of violent conflict disproportionately take root (FAO 2016). In developing countries these programs are often funded by donor nations and are established on a fragmented, ad-hoc basis. When various safety nets and protections are coordinated and government-owned, however, they form a system that spans multiple departments of government, provide a variety of services, and can be easily scaled-up in emergency situations.

The effectiveness of safety nets at preventing conflict has been thoroughly evidenced in the literature. Essex (2012), for example, notes that food-for-work asset building initiatives have been long touted as effective deterrents of terrorist recruitment, providing viable livelihood opportunities for vulnerable populations. These programs, for example, have long been implemented in Afghanistan (Groninger 2012). Food and cash-transfers have also proved successful in deterring riots. As noted by Barrett (2013), "very few of the countries that experienced food price riots between 2007 and 2011 had effective food assistance or other social protection programs in place. Conversely, countries that had broad-based social protection programs—cash transfer, employment guarantees, and other schemes—in place, remained placid" (p. 26). In fact, he continues, "none of the roughly 20 countries that have nationwide conditional or unconditional cash transfer schemes erupted into food riots between 2007 and 2011". Safety net systems like this served as a critical "pressure valve" in a time of shock, expanding to mitigate food access pressures resulting from price spikes.

BOX 6

Ethiopia's social safety net

Ethiopia's Productive Social Safety Net Program (PSNP) and Social Protection Policy demonstrates that effective social safety nets can build trust in government, effectively eroding grievance and economic motivations for engaging in conflict. Ethiopia is no stranger to famine and conflict. In fact, in many ways, the country is the archetype case study for the cyclical relationship between drought, authoritarian or unresponsive governance, and regime change. Ethiopia—sitting at the geographic epicenter of reoccurring El Niño drought in the Horn of Africa—has thus far averted the same debilitating conditions that the country faced in the 1970s and 80's. Since 2005, USAID has supported Ethiopia's PSNP, a cash and food transfer and asset-building safety net program. PSNP reaches nearly 8 million vulnerable people annually in Ethiopia, distributing cash and food and initiating more than 30,000 public works projects each year designed to build critical infrastructure like roads and dams (World Bank 2014). Government-owned and operated, PSNP can expand to reach new beneficiaries when disasters strike. In 2015, in response to the most severe drought in 30 years, the government of Ethiopia spent $700 million from its cash reserves to extend PSNP benefits to those in need. The success of this safety net can be measured in famines, and conflicts, that never happen.

U.S. support for safety net systems is exemplified in the McGovern-Dole International Food for Education and Child Nutrition Program, authorized by Congress in the 2002 Farm Bill. The McGovern-Dole Program provides U.S. commodities to school meals programs in low-income, food insecure countries around the world. It represents a truly bipartisan initiative named for the bill's lead advocates, Senators George McGovern (D-SD) and Bob Dole (R-KS). Today, its support continues in that same bipartisan spirit. In 2016, over $200 million in McGovern-Dole funds were distributed to eight countries in sub-Saharan Africa and Central America. The McGovern-Dole program is especially important in the fight against food-related instability given that education is a powerful tool in countering instability (Asongu & Nwachukwu, 2016). As noted by Brinkman and Hendrix (2011) "education during conflicts can provide a sense of structure and normalcy—along with protection from harm, abduction, and recruitment into armed groups (p. 16). This is a sentiment shared by Senate Agriculture Committee Chairman, Pat Roberts: "The McGovern-Dole program…is a valuable tool in our efforts against terrorism as it provides an opportunity for children, especially young girls, to attend school and gain an education. Promoting food security reduces the chance that these children will be recruited by terrorist groups."

School meal programs provide a transformative link between education and food security. The promise of a nutritious meal has been shown to increase school enrollment and attendance (especially for girls in low-income countries), improve academic performance and can be quickly used to ramp-up food assistance in an emergency by sending additional food rations home with students. School meals that purchase food locally from smallholder farmers can be especially transformative for students and farmers alike. In the 2014 Farm Bill, Congress authorized funding for USDA to introduce a new Local and Regional Procurement component to the McGovern-Dole Program to facilitate such "home-grown school meals." Home-grown school meals can lift smallholders out of extreme poverty by providing stable markets for local producers while simultaneously establishing reliable supply chains that help countries to "graduate" from McGovern-Dole and transfer operational costs of school meals to their domestic budgets.

6. Conclusion

Caption: A child sits amid ruin in Homs, Syria.
Credit: WFP/Abeer Etefa

The link between food insecurity and instability is complex, context-dependent, and mutually reinforcing—but it is not without causation. This should not excuse us from exercising caution or asserting food insecurity to be the sole cause of conflict in any crisis situation. Yet to cite a lack of evidence between food security and global stability as motivation for inaction has no basis in fact. Through carefully designed methodologies and analysis, scholars have been able to empirically verify the link in a variety of settings and conditions and over different time periods. Our review of the literature turned up 53 high-priority articles explicitly taking on the relationship between food insecurity and conflict. Our sample identified 11 separate drivers of food insecurity and at least nine unique manifestations of instability, ranging from peaceful protest to interstate conflict. The sample literature can be divided into three broad, yet interrelated categories of food-related instability: agricultural resource competition; market failure; and extreme weather events.

To summarize, the first category—resource competition—explores longstanding clashes over critical inputs to agricultural production, including land and water. This category addresses the continually evolving relationship between nomadic herders and sedentary agriculturalists, recent trends in global forced migration, and demographic trends relating to population growth and urbanization. The second category—market failure—demonstrates the ways in which food price spikes and other market factors contribute to social unrest. This category has seen a proliferation of studies in the aftermath of the 2007-2008 and 2011 food price crises. Market failure drivers of food-related instability serve to highlight the important distinction between urban unrest and the types of conflict that take root in rural areas. While food riots and demonstrations are an overwhelmingly urban phenomenon, deprivation and economic opportunity deficits in rural areas —distant from policing tools of the state—often play host to more chronic, violent conflict. The third category of food-related instability is extreme weather events. This category underpins resource competition and market failure drivers, and has seen increased interest from scholars writing on the climate-conflict nexus. Given agriculture's outsized contributions to GDP and employment in developing countries and the heavy reliance on rain-fed production, rainfall and temperature variability has been empirically demonstrated to lead to the increased likelihood of conflict in these settings.

As our understanding of food-related instability has improved, so too has the U.S. national security apparatus' response. Given recent trends in international relations, including the elevated role of non-state

> "Food security is not only about food, but it is all about security. Chronic hunger threatens individuals, governments, societies, and borders. People who are starving or undernourished and can't care for their families are left with feelings of hopelessness and despair, which can lead to tension, conflict, even violence."
>
> -Secretary of State Hilary Clinton, 2010

actors and advances in communication technologies that facilitate extremist recruitment, non-traditional drivers of instability like food insecurity are increasingly being recognized within the U.S. national security portfolio. Development activities have been deployed to combat modern threats that are driven not by military might but by the strategic undermining of state legitimacy and the social contract between a government and its people. Programs to address food insecurity—a principle recruitment tool for non-state, violent actors that threaten U.S. security interests—must be at the foundation of these efforts to address the risks of instability in fragile states.

In the agricultural sector, comprehensive approaches to combatting food insecurity have been adopted to effectively sever the link between food insecurity and conflict, focusing on emergency food assistance, agricultural development for smallholders, maternal and childhood nutrition, and social protections. The drivers of food-related instability are diverse, and this combined toolkit is particularly effective at addressing the motivations underlying the decision of food-insecure people to engage in social unrest. Comprehensive food security measures serve to lift populations out of extreme poverty and deprivation, undermining economic motivations for engagement in conflict and building trust in government. In the context of increased state fragility, unprecedented human displacement and the growing intensity and frequency of weather-related disasters, these measures are especially important today. As it was in the aftermath of the Second World War, food security remains key to winning the peace in the international system.

Annexes

Annex 1. "High-priority" academic articles on food-related instability (n=53)

#	Author(s)	Title	Year	Journal	Country	Time Period	Relationship	Food Insecurity Category	Specific Driver	Instability Type	Summary of Relevant Findings
1	Andre, C.; Platteau, J. P.	Land relations under unbearable stress: Rwanda caught in the Malthusian trap	1998	Journal of Economic Behavior & Organization	Rwanda	1988-1993	Positive	Ag. Resource Competition	Land	Civil War	"... acute competition for land [leads to] rising tensions in social relations...thus paving the way for even more overt expressions of disharmony and violence" (Abstract)..." Extreme scarcity of land resources and lack of non-agricultural employment opportunities did not (directly) cause the civil war...yet there can be no doubt that the strained situation engendered by economic scarcities goes a long way toward explaining why violence spread so quickly and so devastatingly through the countryside" (p. 38).
2	Deininger, K.	Causes and consequences of civil strife: Micro-level evidence from Uganda	2003	Oxford Economic Papers	Uganda	1992-2000	Positive	Markets	Ag. Reliance	Isolated Violent Conflict	"...distance from infrastructure...asset inequality, presence of cash crops (expropriable wealth) and lower levels of human capital...all increase the propensity for civil strife" (Abstract).
3	Webersik, C.	Differences that matter: The struggle of the marginalised in Somalia	2004	Africa	Somalia	1990s	Positive	Ag. Resource Competition	Land	Isolated Violent Conflict	"Unjust distribution of pockets of wealth, such as the high-potential agricultural land in the riverine areas in southern Somalia, led to localized [violent] clashes" (Abstract).
4	Ross, M.L.	How do natural resources influence civil war? Evidence from thirteen cases	2004	International Organization	Global	1990s	Uncorrelated	Markets	Ag. Reliance	Civil War	"...oil, nonfuel minerals, and drugs are causally linked to conflict, but legal agricultural commodities are not" (Abstract)..."[It is hypothesized that] primary commodities increase the probability of war by enabling nascent rebel groups to raise money either by extracting and selling the commodities directly, or by exporting money from others who do" (p. 40).
5	Ross, M.L.	What do we know about natural resources and civil war?	2004	Journal of Peace Research	Global	1945 - 2000	Uncorrelated	Markets	Ag. Reliance	Civil War	"...there is no apparent link between legal agricultural commodities and civil war...the association between primary commodities - a broad category that includes both oil and agricultural goods - and the onset of civil war is not robust" (Abstract)... "Even though most rebellions occur in poor countries, and most poor countries are overwhelmingly agricultural, it seems to be rare for rebel forces to receive a disproportionate fraction of their income from the agricultural sector" (p. 347). Furthermore, "there is no statistical evidence —and very little case study evidence—that links agricultural commodities to either the initiation or the duration of civil war." (p. 352).

6	Villarreal, A.	The social ecology of rural violence: Land scarcity, the organization of agricultural production, and the presence of the state	2004	American Journal of Sociology	Mexico	1990-1992	Positive	Ag. Resource Competition	Land	Homicide	"An unequal distribution of land is associated with higher rates of violence. Insecure property rights and the commodification of agricultural production are also conducive to more homicides." (Abstract) "An increase of one standard deviation in Theil's index [regarding this variable] corresponds to a 20.1 percent increase in the homicide rate" (p. 332)..."a smaller average plot size, a greater number of persons per hectare of land, and a higher percentage of agricultural units with a small plot size are all associated with lower rates of homicide" (p. 330).
7	Urdal, H.	People vs. Malthus: Population pressure, environmental degradation, and armed conflict revisited	2005	Journal of Peace Research	Global	1950-2000	Mixed	Ag. Resource Competition	Land	Armed Conflict	"There is some indication that scarcity of potential cropland may have a pacifying effect...where land scarcity combines with high rates of population growth, the risk of armed conflict increases somewhat." (Abstract)... "Neither of these relationships are very robust, though, suggesting that high population pressure on natural resources is not a strong predictor of domestic armed conflict, nor of peace" (p. 430).
8	Hendrix, C. S.; Glaser, S. M.	Trends and triggers: Climate, climate change and civil conflict in Sub-Saharan Africa	2007	Political Geography	Sub-Saharan Africa	2000-2009	Positive	Extreme Weather	Rainfall Variability	Civil War	"Climates more suitable for Eurasian agriculture are associated with a decreased likelihood of conflict while freshwater resources per capita are positively associated with the likelihood of conflict. Moreover, positive changes in rainfall are associated with a decreased likelihood of conflict in the following year" (Abstract)... "reducing dependence on rainwater for agriculture may mitigate conflict" (p. 697).
9	Zhang, D. et al.	Global climate change, war, and population decline in recent human history	2007	PNAS	Global	1400-1900	Positive	Extreme Weather	Temperature Fluctuations	Interstate Conflict	"We show that long-term fluctuations of war frequency and population changes followed the cycles of temperature change. Further analyses show that cooling impeded agricultural production, which brought about a series of serious social problems, including price inflation, then successively war outbreak, famine, and population decline successively" (Abstract).
10	Feridun, M.; Sezgin, S.	Regional underdevelopment and terrorism: The case of South Eastern Turkey	2008	Defence and Peace Economics	Turkey	1987	Positive	Markets	Ag. Reliance	Terrorism	"...total GDP is helpful in explaining terrorism in Turkey... [and] agriculture and government services are more important components of GDP in explaining terrorism than factors such as trade, construction, manufacturing and transportation" (Abstract)..."counter-strategies to reduce terrorism...should support agriculture" (p. 229).
11	Pinstrup-Andersen, P.; Shimokawa, S.	Do poverty and poor health and nutrition increase the risk of armed conflict onset?	2008	Food Policy	Global	1980-2005	Positive	Markets	Undernourishment	Armed Conflict	"... income poverty and poor health and nutritional status are more significantly associated with armed conflict onset than GDP per capita, annual GDP growth, and the ratio of primary commodity exports over GDP. " Furthermore, "a 5 percentage point decrease in under-five child malnutrition contributes to decreasing the likelihood [of armed conflict] by 1.0-3.5 percentage points" (p.519).

12	Peters, K.; Richards, P.	Rebellion and Agrarian Tensions in Sierra Leone	2011	Journal of Agrarian Change	Sierra Leone	1990s	Positive	Ag. Resource Competition	Land	Civil War	"A case is made for regarding the civil war (1991-2002) as being an eruption of long-term, entrenched agrarian tensions exacerbated by chiefly rule. Evidence is presented to suggest that the main rebel movement embodied in its plans to reorganize agricultural production some grasp of these longer-term agrarian problems" (Abstract).
13	Theisen, O. M. et al.	Climate Wars? Assessing the Claim That Drought Breeds Conflict	2011	International Security	Africa	1960-2004	Uncorrelated	Extreme Weather	Drought	Civil War	"...shows little evidence of a drought-conflict connection" (Abstract) "...even though the analysis has been designed to capture the conditions most conducive to violence (agriculture-dependent poor, local political exclusion)" (p 99). "Instead, the local risk of civil war can be explained by sociopolitical and geographic factors: a politically marginalized population, high infant mortality, proximity to international borders, and high local population density." (Abstract)..."[a] possible counterargument is that a drought could further weaken marginalized groups, thereby constituting a temporary obstacle to mobilization"(p. 89) and "although drought does not seem to increase the short-term risk of civil war onset, it may affect its dynamics" (p. 104) and "the rate and extent of past warming and drying will increase manifold in coming decades, so we cannot use historical data to project future trends" (p. 105).
14	Verhoeven, H.	Climate Change, Conflict and Development in Sudan: Global Neo-Malthusian Narratives and Local Power Struggles	2011	Development and Change	Sudan	2000s	Mixed	Extreme Weather	Drought	Civil War	"Darfur has been labeled 'the world's first climate change conflict', masking the long-term political-economic dynamics and Sudanese agency underpinning the crisis" (Abstract)..."This article does not trivialize climate change's effects on resource availability. However, insisting on separating these from social-political mechanisms and cultural meanings that mediate the human-environment relationship adds little in terms of understanding ...the possible emergence of violence" (p. 701).
15	Benjaminsen, T. A. et al.	Does climate change drive land-use conflicts in the Sahel?	2012	Journal of Peace Research	Mali	1992-2009	Mixed	Extreme Weather	Rainfall Variability	Isolated Violent Conflict	"A comparison of the conflict data with statistics on contemporaneous climatic conditions gives little substance to claims that climate variability is an important driver of these conflicts" (Abstract)..."factors other than those directly related to environmental conditions and resource scarcity dominate as plausible explanations of the violent conflict... three structural factors are the main drivers behind these conflicts: agricultural encroachment that obstructed the mobility of herders and livestock, opportunistic behavior of rural actors as a consequence of an increasing political vacuum, and corruption and rent seeking among government officials" (Abstract).

16	Dell, M. et al.	Temperature Shocks and Economic Growth: Evidence from the Last Half Century	2012	American Economic Journal	Global	1950-2003	Positive	Extreme Weather	Temperature Fluctuations	Political Instability	"Higher temperatures have wide-ranging effects, reducing agricultural output, industrial output, and political stability" (Abstract)... "an additional 1 degree Celsius [temperature rise] in poor countries is associated with a 2.7 percentage point increase in the probability of change in [political system]" and "a 1 degree Celsius rise of temperature raises the probability of leader transitions by 3.1 percentage points in poor countries" (p. 86).
17	Sternberg, T.	Chinese drought, bread and the Arab Spring	2012	Applied Geography	Egypt	2011	Positive	Extreme Weather	Drought	Social Unrest	"Potential crop failure due to drought led China to buy wheat on the international market and contributed to a doubling of global wheat prices...China's efforts to minimize the 2011 drought's domestic impacts...had repercussions in Egypt where high food prices were a contributory factor to civil unrest" (Abstract).
18	Berazneva, J.; Lee, D. R.	Explaining the African food riots of 2007-2008: An empirical analysis	2013	Food Policy	Africa	2007-2008	Positive	Markets	Price Spikes	Riots	"...higher levels of poverty, restricted access to and availability of food, urbanization, a coastal location, more oppressive regimes and stronger civil societies are associated with a higher likelihood of riots occurring" (Abstract)... "a one point increase in the [human poverty index] is associated with a 19-32 percent greater odds of riot, on average" (p. 33).
19	Dube, O.; Vargas, J. F.	Commodity Price Shocks and Civil Conflict: Evidence from Colombia	2013	Review of Economic Studies	Colombia	1988-2005	Positive	Markets	Production/Wage Loss	Armed Conflict	"We find that a sharp fall in coffee prices during the 1990s lowered wages and increased violence differently in municipalities cultivating more coffee...We also show that this pattern holds in six other agricultural and natural resource sectors, providing evidence that price shocks affect conflict in different directions depending on the type of the commodity" (Abstract)..."the 68 percent fall in coffee prices over 1997 to 2003 resulted in 18 percent more guerilla attacks, 31 percent more paramilitary attacks, 22 percent more clashes, and 14 percent more casualties in the average coffee municipality" (p. 1385).
20	Ember, C. R. et al.	Risk, Uncertainty, and Violence in Eastern Africa	2013	Human Nature	East Africa	Unknown	Positive	Ag. Resource Competition	Land	Armed Conflict	"Previous research on warfare in a worldwide sample of societies by Ember and Ember found a strong relationship between resource unpredictability (particularly food scarcity caused by natural disasters) in non-state, non-pacified societies and overall warfare frequency...Results support previous worldwide results regarding the relationship between resource unpredictability and warfare frequency...In almost all findings, relationships are generally in opposite directions in non-state and state societies. In post-hoc analyses, atrocities are significantly more likely to be committed in states than in non-states" (Abstract).

21	Lee, H. F.	Positive correlation between the North Atlantic Oscillation and violent conflicts in Europe	2013	Climate Research	Europe	1400-1995	Positive	Extreme Weather	Temperature Fluctuations	Isolated Violent Conflict	"Violent conflicts were more prevalent in historical Europe during colder periods, caused by food scarcity...Our results show that the North Atlantic Oscillation (NAO) was positively correlated with violent conflicts, particularly in southern Europe and the Mediterranean. Results hold up even with different measures of violent conflict" (Abstract)... "Nevertheless, the NAO-conflict correlation has weakened since the Industrial Revolution. Our result is the first demonstration that the NAO affected social stability in pre-industrial societies. This knowledge is crucial in examining violent conflicts in northwestern Africa, a region affected by the NAO, as well as being highly agricultural" (Abstract).
22	McKune, S. L.; Silva, J. A.	Pastoralists under Pressure: Double Exposure to Economic and Environmental Change in Niger	2013	Journal of Development Studies	Niger	2005-2010	Positive	Ag. Resource Competition	Land	Political Instability	"...economic and environmental change drives recent political instability and food crises in Niger and the resultant implications for the food security of pastoral populations" (Abstract)... "pastoralists [in Niger] are moving further afield in search of grazing land and water, which often means travelling farther south, where average rainfall is slightly higher...in doing so, pastoral communities encroach upon agricultural lands...some pastoralists are choosing to sedentarise" (p. 1722).
23	Piazza, J. A.	The Cost of Living and Terror: Does Consumer Price Volatility Fuel Terrorism?	2013	Southern Economic Journal	Global	1970-2010	Positive	Markets	Price Volatility	Terrorism	"Food price fluctuations are significant predictors of multiple measures of terrorism, while energy and housing prices are not. Second, rapid food price increases, not decreases, promote terrorist attacks. Third, the relationship between food price volatility and terrorism is most consistently present in nondemocratic and "hybrid" political regimes and in medium human development countries rather than in democracies or in countries characterized by very high or very low economic development" (Abstract).
24	Alem, Y.; Kohlin, G.	The Impact of Food Price Inflation on Subjective Well-being: Evidence From Urban Ethiopia	2014	Social Indicators Research	Ethiopia	2008-2009	Positive	Markets	Price Spikes	Social Unrest	"We show that being negatively affected by a food price shock reduced subjective well-being of households significantly, although the economy was growing rapidly" (Abstract)..."we show that that the average reported level of life satisfaction in urban Ethiopia declined during the period of economic growth (p. 855)..."moving from not affected at all by food price inflation to being affected very negatively increases the probability that one is very dissatisfied by 10.4 percent" (p. 860).

25	Gleick, P. H.	Water, Drought, Climate Change, and Conflict in Syria	2014	Weather Climate and Society	Syria	2014	Positive	Ag. Resource Competition	Water	Civil War	"Water and climatic conditions have played a direct role in the deterioration of Syria's economic conditions. There is a long history of conflicts over water in these regions because of the natural water scarcity, the early development of irrigated agriculture, and complex religious and ethnic diversity" (Abstract)..."some of the earliest unrest began in the town of Dara'a, which saw a particularly large influx of farmers and young unemployed men displaced off their lands by crop failures" (p. 335)... "Over the past century (from 1900 to 2005), there were six significant drought in Syria...five of these droughts lasted only one season; the sixth last two...Starting in 2006, however, and lasting into 2011, Syria experienced a multi-season, multi-year period of extreme drought...the worst long-term drought and most severe set of crop failures since agricultural civilizations began in the Fertile Crescent many millennia ago" (p. 332) "Between 2006 and 2009, 1.3 million inhabitants of eastern Syria were affected by agricultural failures. An estimated 800,000 people lost their livelihoods or basic food supports" (p. 334).
26	Hossain, N.; Kalita, D.	Moral economy in a global era: The politics of provisions during contemporary food price spikes	2014	Journal of Peasant Studies	Bangladesh,Indonesia, Kenya, Zambia	2011	Positive	Markets	Price Spikes	Riots	"The wave of food riots since 2007 revived interest in why people protest in periods of dearth, yet research has to date failed to make sense of the political cultures of food protests" (Abstract)... "There is common ground [between these countries] in beliefs that markets are manipulated or fail, chiefly because of elite collusion or greed, that authorities have the power and the responsibility to act, and that direct action may be necessary to correct failures to do so" (p. 828).
27	Maystadt, J. F.;Ecker, O.	Extreme Weather and Civil War: Does Drought Fuel Conflict in Somalia through Livestock Price Shocks?	2014	American Journal of Agricultural Economics	Somalia	1997-2009	Positive	Extreme Weather	Drought	Isolated Violent Conflict	"Causality is also valid for droughts and local violent conflicts in a within-country setting over a short time frame in the case of Somalia. We estimate that a one standard deviation increase in drought intensity and length raises the likelihood of conflict by 62 percent" (Abstract).
28	Maystadt, J. F. et al.	Does food security matter for transition in Arab countries?	2014	Food Policy	MENA	1960-2010	Positive	Markets	Undernourishment	Political Instability	"Results show that unlike in other studies where per capita incomes, inequality, and poor governance, among other factors, emerge as the major determinants of conflict, food security at macro and household-levels emerges as the main cause of conflicts in the Arab World" (Abstract)... "food security, both measured at the macro level (the ratio of food imports to total exports plus remittances) and at the household level (child stunting), emerges as the main driver of conflicts in the region" (pp. 113-4).

29	Salehyan, I.; Hendrix, C. S.	Climate shocks and political violence	2014	Global Environmental Change	Global	1970-2006	Positive	Extreme Weather	Rainfall Variability	Isolated Violent Conflict	"... explores the relationship between environmental scarcity and political violence in a global sample of countries, 1970-2006. We find that water abundance is positively correlated with political violence, and that this relationship is stronger in less developed, more agriculturally dependent societies" (Abstract)... "a one (two) standard deviation increase in precipitation anomaly is associated with a 4.3 percent (8.8 percent) increase in the number of attacks, a 6.9 percent (14.2 percent) increase in the number of deaths associated with those attacks...[furthermore] a one-percentage point increase in economic growth is associated with a 0.7 percent decrease in the frequency of [conflict]" (p. 247).
30	Smith, T. G.	Feeding unrest: Disentangling the causal relationship between food price shocks and socio-political conflict in urban Africa	2014	Journal of Peace Research	Africa	1990-2012	Positive	Markets	Price Spikes	Social Unrest	"Sudden increase in domestic food prices in a given month significantly increases the probability of urban unrest, especially spontaneous events and riots, in that month." (Abstract)..."one standard deviation above the long term mean [in food prices] increases the odds of unrest between 64.8 and 78.8 percent" (p. 689).
31	von Uexkull, N.	Sustained drought, vulnerability and civil conflict in Sub-Saharan Africa	2014	Political Geography	Sub-Saharan Africa	1989-2008	Positive	Extreme Weather	Drought	Isolated Violent Conflict	"Areas with rainfed croplands see an increased risk of civil conflict violence following drought. There is also some support for the proposition that areas experiencing sustained droughts have a higher risk of conflict" (Abstract).
32	Wischnath, G.; Buhaug, H.	Rice or riots: On food production and conflict severity across India	2014	Political Geography	India	1980-2011	Positive	Markets	Production/Wage Loss	Isolated Violent Conflict	"Harvest loss is robustly associated with increased levels of political violence. To the extent that future climate change will negatively affect local food production and economic activity, it appears that it also has the potential to fuel further fighting in areas that already are scenes of chronic conflict" (Abstract).
33	Bellemare, M. F.	Rising Food Prices, Food Price Volatility, and Social Unrest	2015	American Journal of Agricultural Economics	Global	1990-2011	Positive	Markets	Price Spikes	Social Unrest	"Results indicate that for the period 1990-2011, food price increases have led to increases in social unrest, whereas food price volatility has not been associated with increases in social unrest" (Abstract)..."whereas food price volatility has not had the posited effect on social unrest. In fact, in the base of cases, food price volatility is actually associated with decreases in social unrest" (p. 3).

34	Bollfrass, A.; Shaver, A.	The Effects of Temperature on Political Violence: Global Evidence at the Subnational Level	2015	Plos One	Global	1994-2014	Mixed	Extreme Weather	Temperature Fluctuations	Isolated Violent Conflict	"[takes on] the untested assumption that the mechanism behind the temperature-conflict link is that disruption of agricultural production provokes local violence... Diminished local farm output resulting from elevated temperatures is unlikely to account for the entire increase in sub-state violence" (Abstract)... "a difference in mean temperature of 20F is associated with an approximate 2 percent change in the likelihood of deadly conflict" (p. 4)..."that the relationship [between food temperature and violence] exists even in areas of the world without croplands should direct further investigations away from this assumption" (p. 1)... "a substantial portion of the variation is brought about by the well-documented direct effects of temperature on individuals' propensity for violence or through macroeconomic mechanisms such as food price shocks" (Abstract).
35	Bretthauer, J. M.	Conditions for Peace and Conflict: Applying a Fuzzy-Set Qualitative Comparative Analysis to Cases of Resource Scarcity	2015	Journal of Conflict Resolution	Global	1990-2010	Positive	Markets	Agricultural Reliance	Social Unrest	"...[the study] yields two pathways to conflict. Both contain low levels of tertiary education, high levels of dependence on agriculture, and high poverty levels" (p. 604)... "agricultural dependence combined with poverty and low levels of tertiary education leads to conflict and the absence of dependence on agriculture is a necessary condition for a non-conflict outcome" (p. 609).
36	Buhaug, H. et al.	Climate variability, food production shocks, and violent conflict in Sub-Saharan Africa	2015	Environmental Research Letters	Sub-Saharan Africa	1960-2010	Mixed	Markets	Production/Wage Loss	Isolated Violent Conflict	"...analysis reveals a robust link between weather patterns and food production where more rainfall generally is associated with higher yields. However, the second step in the causal model is not supported; agricultural output and violent conflict are only weakly and inconsistently connected, even in the specific contexts where production shocks are believed to have particularly devastating social consequences" (Abstract)..." the wider socioeconomic and political context is much more important than drought and crop failures in explaining violent conflict in contemporary Africa. (Abstract) ... "importantly, we do not account for how agricultural deficit among major global food exporters as well as international food price volatilities translate into domestic food insecurity in vulnerable societies, and to what extent political leaders are able and willing to implement effective countermeasures" (p.9).
37	Fjelde, H.	Farming or Fighting? Agricultural Price Shocks and Civil War in Africa	2015	World Development	Africa	1990-2010	Positive	Markets	Price Spikes	Civil War	"Negative changes to the local agricultural price index significantly and substantially increase the risk of violent events" (Abstract)..."a 20 percent drop in the local agricultural price index is associated with a 0.3 percent increase in the predicted risk of conflict in the cell, and an addition 0.6 percent with a lag. Summing the effect on impact and the lagged effect yields a total increase in the risk of violence of 0.9 percent" (p. 531).

38	Hendrix, C.; Haggard, S.	Global food prices, regime type, and urban unrest in the developing world	2015	Journal of Peace Research	Asia, Africa	1961-2010	Positive	Markets	Price Spikes	Social Unrest	"Democracies are more prone to urban unrest during periods of high food prices than autocracies" (Abstract)... "a one SD increase in [food prices] from its mean value is associated with a 35 percent increase in the frequency of protesting and rioting in democracies and a 28.9 percent increase...in atrocities... global food prices are not correlated with protest and rioting in autocracies" (p. 150).
39	Hitchcock, R. K. et al.	Settler colonialism, conflicts, and genocide: Interactions between hunter-gatherers and settlers in Kenya, and Zimbabwe and northern Botswana	2015	Settler Colonial Studies	Kenya, Zimbabwe, Botswana	~1900	Positive	Ag. Resource Competition	Land	Social Unrest	"Lands populated by indigenous hunter-gatherers were taken over by settlers, ranchers, state institutions, and private companies. Conflicts between the groups occurred, although there was variation in the degree to which relationships were characterized by violence" (Abstract).
40	Kelley, C. P. et al.	Climate change in the Fertile Crescent and implications of the recent Syrian drought	2015	PNAS	Syria	~2005-2010	Positive	Extreme Weather	Drought	Civil War	"For Syria, a country marked by poor governance and unsustainable agricultural and environmental policies, the drought had a catalytic effect, contributing to political unrest" (Abstract)... "the most significant consequence was the migration of as many as 1.5 million people from rural farming areas to the peripheries of urban centers" (p. 3241)..."One critical consequence of these unsustainable policies in the decline in groundwater...pumped groundwater supplies over half (60 percent) of all water for irrigation purposes" (p. 3241).
41	Legwegoh, A. F. et al.	Do Dietary Changes Increase the Propensity of Food Riots? An Exploratory Study of Changing Consumption Patterns and the Inclination to Engage in Food-Related Protests	2015	Sustainability	Cameroon	2014	Positive	Markets	Price Spikes	Riots	"Results show that some 70 percent of the respondents would riot if food prices went up. Also, in the event of food price rises: (1) households in Cameroon's major cities are more likely to riot than the citizens of smaller cities; (2) Households with relatively higher educational level, high incomes, are less likely to riot" (Abstract)... "based on the 12 food groups that we used to capture dietary trends, the logit model shows that those who had increased their consumption of [roots, egg, oil, sugar] had a higher propensity to riot than those who had not increased their consumption of [these products]" (p. 14125).

42	Natalini, D. et al.	Quantitative Assessment of Political Fragility Indices and Food Prices as Indicators of Food Riots in Countries	2015	Sustainability	Global	2005-2011	Positive	Markets	Price Spikes	Riots	"The self-sufficiency of food does not seem to affect the likelihood of the occurrence of food riots, but that the level of political stability of a country does have a role. In addition, we identify a monthly and annual threshold for the Food and Agriculture Organization Food Price Index, above which food riots in fragile states are more likely to occur" (Abstract)... "we tested [the] hypothesis...food riots are more likely to happen in countries that are net food importers...[and] and only had marginal evidence to support it within the data analysis, and therefore, we reject it" (p. 4376)..."the likelihood of experiencing a food riot increases with the increase in fragility (more fragile countries in the first quartile have a 37 percent likelihood of a riot event compared to 18 percent likelihood for the second quartile)" (p. 4376-7).
43	O'Trakoun, J.	Food Price Uncertainty and Political Conflict	2015	International Finance	Global	1966-1990	Positive	Markets	Price Uncertainty	Armed Conflict	"...shocks to the uncertainty of commodity export prices can elicit civil conflict in a small open economy. Econometric evidence from a cross-country panel data set documenting intrastate civil conflict and global food commodity prices from 1966-90 lends support to this hypothesis" (Abstract)... "shocks to the uncertainty of food commodity export prices can cause civil conflict in developing countries...an increase in uncertainty regarding future relative export prices is associated with an increased risk of political conflict" (p. 300).
44	Raleigh, C. et al.	The devil is in the details: An investigation of the relationships between conflict, food price and climate across Africa	2015	Global Environmental Change	Africa	1997-2010	Positive	Markets	Price Spikes	Isolated Violent Conflict	"...find that: (i) a positive feedback exists between food price and violence - higher food prices increase conflict rates within markets and conflict increases food prices; (ii) anomalously dry conditions are associated with increased frequencies of conflict; and (iii) decreased rainfall exerts an indirect effect on conflict through its impact on food prices" (Abstract)... "A 100 percent increase in food prices is associated with a 13 percent increase in the expected number of conflict events within a given market and month" (p. 193)..."when the number of conflict events is doubled, food price is expected to increase by about 1.6 percent" (p. 193)..."a one standard deviation decrease in rainfall levels from the long-term average during the past 30-120 days is expected to increase food prices by about 9.1 percent" (p. 194)..."the presence of drought raises food prices by about 4.4 percent and this in turn produces about one more conflict event within a given market and month" (p. 195).
45	Sarsons, H.	Rainfall and conflict: A cautionary tale	2015	Journal of Development Economics	India	1950-1995	Mixed	Extreme Weather	Rainfall Variability	Riots	"...identify districts that are downstream from irrigation dams and show that income in these areas is much less sensitive to rainfall fluctuations. However, rain shocks remain equally strong predictors of riot incidence in these districts" (Abstract)...The author suggests that riot spillover and migration from rainfed districts and demographic features of dam-fed districts may contribute to this counterintuitive finding.

46	Weinberg, J.; Bakker, R.	Let them eat cake: Food prices, domestic policy and social unrest	2015	Conflict Management and Peace Science	Global	1972-2007	Positive	Markets	Price Volatility	Social Unrest	"...show a positive and significant relationship between food prices and outbreak of social unrest and conflict across a wide range of countries" (Abstract)... "Instances of social unrest are more common in years in which food prices have increased, with larger increases leading to higher counts...This result supports our position that the important effect of food price on domestic unrest is found in the change in price—rather than the level of the price" (p. 320).
47	Caruso, R. et al.	Climate change, rice crops, and violence: Evidence from Indonesia	2016	Journal of Peace Research	Indonesia	1993-2003	Positive	Extreme Weather	Temperature Fluctuations	Isolated Violent Conflict	" ...an increase of the minimum temperature during the core month of the rice growing season, that is, December, determines an increase in violence stimulated by the reduction in future rice production per capita" (Abstract)... "Studies concentrating on several countries with different crops and using variations of average temperature as a measure of climate change missed the biological mechanism behind the relationship between climate change and violence" (Abstract).
48	Koren, O.; Bagozzi, B. E.	From global to local, food insecurity is associated with contemporary armed conflicts	2016	Food Security	Global	1991-2008	Positive	Markets	Production/Wage Loss	Interstate and Intrastate Conflict	"Food insecurity measures are robustly associated with the occurrence of contemporary armed conflict" (Abstract)..."political violence will have a higher likelihood of concentration in regions that (i) offer more access to food resources and (ii) face low levels of food availability within areas that offer some access to food" (p. 1007)..."Unsupported warring groups on all sides of a conflict may move into regions that offer more access to cropland in order to forage and pillage to support themselves, which in turn produces higher incidences of hostilities, especially if there is not enough food per person available in these fertile regions" (p. 1007).
49	Papaioannou, K. J.	Climate shocks and conflict: Evidence from colonial Nigeria	2016	Political Geography	Nigeria	1912-1945	Positive	Extreme Weather	Rainfall Variability	Homicide	"We find a robust and significant...relationship between rainfall deviations and conflict intensity, which tends to be stronger in agro-ecological zones that are least resilient to climatic variability (such as Guinean Savannah) and where (pre-) colonial political structures were less centralized...the relationship is weaker in areas that specialize in the production of export crops (such as cocoa and palm oil) compared to subsistence farming areas, suggesting that agricultural diversification acts as an insurance mechanism against the whims of nature" (Abstract)... "an additional increase of rainfall deviation led to an average of 62.4 additional homicides" (p. 18).

50	Su, Y. et al.	The relationship between climate change and wars waged between nomadic and farming groups from the Western Han Dynasty to the Tang Dynasty period	2016	Climate of the Past	China	206 B.C. -906 A.D.	Positive	Extreme Weather	Temperature Fluctuations	Armed Conflict	"On a decadal timescale, warm climates corresponded to a high incidence of wars...While farming groups were inclined to initiate wars during dry and cold periods, their chances of achieving victory were reduced at such times...the overriding desire of nomadic groups to expand essential subsistence means led to wars... While other factors also influenced these wars, climate change served as a backdrop, playing an indirect role in wars between these groups" (Abstract).
51	Tubi, A.; Feitelson, E.	Drought and cooperation in a conflict prone area: Bedouin herders and Jewish farmers in Israel's northern Negev, 1957-1963	2016	Political Geography	Israel	1957-1963	Mixed	Ag. Resource Competition	Land	Isolated Violent Conflict	"Violence was limited and occurred only when some of the Bedouins migrated to the more northern Mediterranean zone...The severity of conflicts increased when farmers and herders lacked previous familiarity" (Abstract).
52	van Weezel, S.	Food imports, international prices, and violence in Africa	2016	Oxford Economic Papers	Africa	1990-2011	Mixed	Markets	Price Spikes	Isolated Violent Conflict	"Food price increases are associated with higher levels of violence...moving from low to high values in the price index corresponds, after controlling for economic, social, and political factors, to an increase in violence intensity of 1.3 incidents... Despite the statistically significant results, the predictive power of food prices is relatively low, both in and out of sample. Using 2012 data for out-of-sample forecast shows that food prices are a relatively poor predictor of violence"... "the correlation between food prices and unrest is predominantly drive by low-value added primary products such as wheat..." (p. 4).
53	von Uexkull, N. et al.	Civil conflict sensitivity to growing-season drought	2016	PNAS	Africa, Asia	1989-2014	Mixed	Extreme Weather	Drought	Civil War	"...a drought under most conditions has little effect on the short-term risk that a group challenges the state by military means. However, for agriculturally dependent groups as well as politically excluded groups in very poor countries, a local drought is found to increase the likelihood of sustained violence" (Abstract).

Annex 2. Review search criteria and database specifications

To establish a sample of academic articles on food-related instability (Annex 1), the Web of Science Core Collection database was accessed, a multidisciplinary indexing service containing over 90 million records. The database was queried with the following word search combinations on February 6th, 2017:

Table 1. Word Search Combinations

	Theme 1		Theme 2
Preferred Search	"Food Insecurity"	and	"Instability"
Variations	"Food" "Agricult*" "Nutrition*" "*nourishment" "Hunger" "Famine"	and	"National Security" "Violent Conflict" "Instability" "War" "Violen*" "Unrest" "Insurgenc*" "Riot*" "Terror*" "Extremis*"

The boolean operator search modifier "" is used to capture root or commonly truncated word variations.

This search matrix resulted in 77 unique word combinations, yielding 3,103 (5,062, of which 1,959 were duplicates) articles containing these combined terms in the title, abstract, or keyword fields of the article's metadata. These 3,000+ articles were downloaded to EndNote bibliographic referencing software for manual review. The abstracts for all articles were reviewed and sorted in to "priority" (n=564) and "high priority" (n=53) categories. This review did not extend to first order references within the sample (i.e. relevant articles cited within the sample articles), a practice common to systematic reviews.

Annex 3. Global food security and fragility (Figure 1)

2016 IFPRI Global Hunger Index (Significant Concern, Serious, Alarming, Extremely Alarming)	
Afghanistan	34.8
Angola	32.8
Bangladesh	27.1
Benin	23.2
Botswana	23
Burkina Faso	31
Burundi	IDSC*
Cambodia	21.7
Cameroon	22.9
Central African Republic	46.1
Chad	44.3
Comoros	IDSC
Congo, Rep.	26.6
Côte d'Ivoire	25.7
Democratic Republic of Congo	IDSC
Djibouti	32.7
Eritrea	IDSC
Ethiopia	33.4
Gambia	20.9
Guatemala	20.7
Guinea	28.1
Guinea-Bissau	27.4
Haiti	36.9
India	28.5
Indonesia	21.9
Iraq	22
Kenya	21.9
Lao PDR	28.1
Lesotho	22.7
Liberia	30.7
Libya	IDSC

2016 OECD Fragility Index (Fragile or Extremely Fragile)	
Afghanistan	Extreme Fragility
Angola	Fragile
Bangladesh	Fragile
Burkina Faso	Fragile
Burundi	Extreme Fragility
Cambodia	Fragile
Cameroon	Fragile
Central African Republic	Extreme Fragility
Chad	Extreme Fragility
Comoros	Fragile
Congo	Fragile
Côte d'Ivoire	Fragile
Democratic Republic of Congo	Extreme Fragility
Egypt	Fragile
Eritrea	Extreme Fragility
Ethiopia	Extreme Fragility
Gambia	Fragile
Guatemala	Fragile
Guinea	Fragile
Guinea-Bissau	Fragile
Haiti	Extreme Fragility
Honduras	Fragile
Iraq	Extreme Fragility
Kenya	Fragile
Lao PDR	Fragile
Lesotho	Fragile
Liberia	Fragile
Libya	Fragile
Madagascar	Fragile
Malawi	Fragile
Mali	Extreme Fragility

Madagascar	35.4		**Mauritania**	Fragile
Malawi	26.9		**Mozambique**	Fragile
Mali	28.1		**Myanmar**	Fragile
Mauritania	22.1		**Niger**	Fragile
Mozambique	31.7		**Nigeria**	Fragile
Myanmar	22		**North Korea**	Fragile
Namibia	31.4		**Pakistan**	Fragile
Nepal	21.9		**Papua New Guinea**	Fragile
Niger	33.7		**Rwanda**	Fragile
Nigeria	25.5		**Sierra Leone**	Fragile
North Korea	28.6		Solomon Islands	Fragile
Pakistan	33.4		**Somalia**	Extreme Fragility
Papa New Guinea	IDSC		**South Sudan**	Extreme Fragility
Rwanda	27.4		**Sudan**	Extreme Fragility
Sierra Leone	35		**Swaziland**	Fragile
Somalia	IDSC		**Syria**	Extreme Fragility
South Sudan	IDSC		**Tajikistan**	Fragile
Sri Lanka	25.5		**Tanzania**	Fragile
Sudan	IDSC		**Timor-Leste**	Fragile
Swaziland	24.2		**Uganda**	Fragile
Syria	IDSC		Venezuela	Fragile
Tajikistan	30		West Bank and Gaza Strip	Fragile
Tanzania	28.4		**Yemen**	Extreme Fragility
Timor-Leste	34.3		**Zambia**	Fragile
Togo	22.4		**Zimbabwe**	Fragile
Uganda	26.4			
Yemen	35			
Zambia	39			
Zimbabwe	28.8			

Bold = Included in both rankings
*Insufficient Data, Significant Concern

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