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Bryan L. McDonald

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**FOOD AS A KEY RESOURCE FOR
SECURITY AND STABILITY:
IMPLICATIONS OF CHANGES IN THE
GLOBAL FOOD SYSTEM 1950-2000**

*Bryan L. McDonald, PhD**

INTRODUCTION¹

When world leaders gathered in 2009 at the G-8 Summit in L'Aquila, Italy, food was a major topic of concern. The assembled leaders pledged to “act with the scale and urgency needed to achieve sustainable global food security.”² There was good reason for their focus. By the early twenty-first century, food, long a subject of concern for the security, stability and prosperity of societies, had re-emerged as a topic of broad interest in the U.S. and around the world. This attention was driven by a number of trends, including: far-ranging and high-profile food safety episodes; record high rates of chronic hunger and obesity; outbreaks of violence and unrest fueled in part by high food prices and high price volatility; and concern about impacts on food systems from changing trends in weather and

* [Bryan McDonald](#), Assistant Professor of History at the Pennsylvania State University.

¹ This article updates and extends arguments and material first presented in BRYAN L. McDONALD, *FOOD SECURITY* (2010).

² G8 Summit Statement on Food Security, “L'Aquila” *Joint Statement on Global Food Security: L'Aquila Food Security Initiative (AFSI)* 1 (July 10, 2009), http://www.g8italia2009.it/static/G8_Allegato/LAquila_Joint_Statement_on_Global_Food_Security%5B1%5D,0.pdf (last visited Feb. 20, 2014).

climate.³ Events of the early twenty-first century demonstrate that ensuring food security remains an urgent problem that affects the security and national interests of states, as well as the human security of people and communities around the world. For example, in its 2014 Worldwide Threat Assessment, the U.S. Intelligence Community recognized competition for secure access to food as a growing security threat.⁴ This article examines how the landscape of food security threats and vulnerabilities is changing and identifies three sets of concerns that are converging to amplify, disrupt, and transform efforts to ensure that all people are food secure: nutrition, food safety, and global environmental change.

I. FOOD SECURITY IN AN AGE OF GLOBAL CHANGE

While many definitions of food security exist, the most commonly used definition holds that food security “exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.”⁵ The key components of food security are: availability, access, utilization, and stability.⁶ Globalization and global environmental change have significantly impacted the ways people get food and have given rise to a complex, transnational network of food systems that includes a range of activities and processes related to food.⁷

³ Ban Ki-moon, *The New Face of Hunger*, WASH. POST, Mar. 12, 2008, <http://www.washingtonpost.com/wp-dyn/content/article/2008/03/11/AR2008031102462.html>.

⁴ James R. Clapper, *Statement for the Record: Worldwide Threat Assessment of the US Intelligence Community*, SENATE SELECT COMM. ON INTELLIGENCE 9-10 (Jan. 29, 2014), <http://www.intelligence.senate.gov/140129/clapper.pdf>.

⁵ Food and Agriculture Organization of the U.N., *The State of Food Insecurity in the World: Addressing Food Insecurity in Protracted Crises* 8 (2010), www.fao.org/docrep/013/i1683e/i1683e.pdf.

⁶ Feed the Future, *Feed the Future Guide*, at iv (May 2010), http://feedthefuture.gov/sites/default/files/resource/files/FTF_Guide.pdf.

⁷ See FOOD SECURITY, *supra* note 1.

The global food network brings new opportunities—ranging from a greater variety of foods to improved economic development options—but also new threats and vulnerabilities.⁸ Without a full understanding of the risks and opportunities posed by such networks they cannot be used to their full potential to address pressing global problems such as enhancing security, ensuring prosperity, alleviating poverty, and improving the status of women. Concurrently, the emerging structure of the pattern of relations involved in connecting places and people through food highlights the challenge of governing complex, networked systems that are becoming increasingly common and impactful in global affairs.

Globalization is a primary driver of changes occurring in food systems and has brought increased interconnectedness, mobility, and access for transnational flows of goods, people, and information.⁹ Globalization can be understood as a set of processes involving increasing speed and scale of interactions that operate through networks and are transforming many aspects of daily life.¹⁰ Collectively, globalization is a long-running series of processes of increased integration.¹¹ For the most part, these changes in economic, political, social, technological, and environmental domains are leading toward real material improvements in everyday life for many people in many parts of the world. Acknowledging that globalization is a long-term phenomenon, however, should not deter recognition that there is something distinctive about contemporary changes based on the speed, scale, and networked form of contemporary globalization processes.

The concept of networks is integral to understanding the emerging global food system, in part because we live in a time of networks such as the Internet, electrical power grids, and the air transit system. Networks, at the most general level, are an

⁸ *Id.*

⁹ *Id.*

¹⁰ DAVID HELD, ANTHONY MCGREW, DAVID GOLDBLATT & JONATHAN PERRATON, *GLOBAL TRANSFORMATIONS: POLITICS, ECONOMICS AND CULTURE* 16 (1999).

¹¹ William H. McNeill, *Globalization: Long Term Process or New Era in Human Affairs?* 2 *NEW GLOBAL STUDIES* 11 (Jan. 2008).

interconnection of systems that allow sharing between systems and contain regularized interactions between nodes of activity.¹² One of the key features of networks is that they collapse distances, though not in a traditional, geometric sense. In networks, the shortest distance between two points often involves traveling through a hub, rather than directly from node to node. While networks can continue to function with the loss of some or many nodes, disruption of a hub can have a significant impact on the overall network and cascading impacts on other networks.¹³ Working through networks of trade, information, and travel, globalization is impacting many aspects of daily life in many parts of the world.

In recent decades, local, regional, and national food systems have become linked in an emerging global food network. This complex web of relations is often referred to as the food system and it includes the production, gathering, harvesting, processing, transporting, preparing, and consuming of food.¹⁴ However, it is vital to recognize that while food systems are increasingly interconnected, they are not a fully incorporated system in the sense of being an integrated whole. As the U.K. Government's long range planning group, Foresight, recognizes, this food network is "not a single entity, but rather a partially self-organised collection of interacting parts."¹⁵ The networked form of global food relations is deeply significant to contemporary challenges related to the production, governance, and security of food.¹⁶

The emerging geography of world food problems is deeply uneven, and the global food network is filled with pockets of both abundance and scarcity. Yet, the terrain of this landscape does not

¹² ALBERT-LÁSZLÓ BARABÁSI, LINKED: HOW EVERYTHING IS CONNECTED TO EVERYTHING ELSE AND WHAT IT MEANS FOR BUSINESS, SCIENCE, AND EVERYDAY LIFE 1-8 (2003).

¹³ THOMAS HOMER-DIXON, THE UPSIDE OF DOWN: CATASTROPHE, CREATIVITY, AND THE RENEWAL OF CIVILIZATION 116-22 (2006).

¹⁴ See, e.g., ROBERT GOTTLIEB & ANUPAMA JOSHI, FOOD JUSTICE (2010).

¹⁵ Foresight, *The Future of Food and Farming: Challenges and Choices for Global Sustainability* THE GOV'T OFFICE FOR SCI. 10 (Jan. 2011).

¹⁶ *Id.* at 13-15.

map evenly or cleanly onto any traditional models of the world such as North/South or Developed/Developing.¹⁷ The creation of this global food network has happened as the result of many decisions in a wide variety of locations including farm fields, scientific and commercial laboratories, governmental agencies, and international negotiations.¹⁸ Food insecurity is driven by a complex mix of economic, environmental, political, and social factors including: population growth, increased purchasing power and changing dietary preferences, variability and severe weather events, conflict and instability, and further integration of food systems into global financial systems.¹⁹

The global food network operates through a vast web of goods and services to link people and places across the globe. Given this, it is a useful lens to use in examining one of the key questions in global relations at this moment: how and to what extent can ways be found to govern networks and harness them to enhance national security and advance vital national interests? Although this global food network is influenced by the actions of states, it is also transnational in the sense that it spans state borders and involves a range of actors at the state level as well as actors in international, private, and non-state sectors.²⁰ Recent events and global trends have combined to create what Laurie Garrett recognizes as a “destabilizing moment in terms of global governance and any ability to come up with reasonable, rational ways to globalize the food supply.”²¹

Examinations of food security highlight how the networks which are empowering people and bringing prosperity and improvements in health and welfare are also amplifying traditional security challenges, such as hunger and malnutrition, as well as giving

¹⁷ FOOD SECURITY, *supra* note 1.

¹⁸ *Id.*

¹⁹ *Id.*

²⁰ Richard A. Matthew & George E. Shambaugh. *Sex, Drugs, and Heavy Metal: Transnational Threats and National Vulnerabilities*, 29 SEC. DIALOGUE, 163-75 (1998).

²¹ Interview by Toni Johnson with Laure Garrett, Senior Fellow for Global Health, CFR (Feb. 4, 2011), <http://www.cfr.org/food-security/food-prices-global-instability/p24018>.

rise to new vulnerabilities and new kinds of threats, such as large-scale, transnational food safety episodes.

To understand food security, it is necessary to ask not just how global change is shifting the landscape of food security threats and vulnerabilities, but also to consider how world food problems are emerging as questions that are key to global governance, prosperity, and security.

In the increasingly globalized food network, fewer people and nations produce for themselves the food they require and are increasingly dependent on the global network of food systems. Even as human societies become more urban and industrialized, agriculture and food production remain key components of local, state, national, and global economies. Recent events have resulted in a greater amount of attention being paid to food security concerns.²² There is good reason for a renewed focus on food security as lack of food security impacts billions of people on a daily basis and contributes to significant human insecurity. This section describes three sets of challenges that are converging to amplify, disrupt, and transform food security.

II. ENSURING NUTRITION

Improvements in food production and global health during the twentieth century allowed human societies to flourish through dramatic increases in global population size, life expectancy, and reductions in infant and child mortality rates. Despite these advances, malnutrition remains a widespread form of food insecurity that affects billions of people on a daily basis. Malnutrition is the collective term applied to a variety of forms of poor nutrition.²³ A full discussion of malnutrition encompasses not just the classical food

²² See, e.g., Ban, *supra* note 3.

²³ See Per Pinstrup-Andersen, *Agricultural Research and Policy for Better Health and Nutrition in Developing Countries: A Food Systems Approach*, 37 AGRIC. ECON. 187, 190-92 (2007).

security problem of chronic hunger (people who do not receive sufficient energy from their diets), but also must consider problems related to people who do not receive an adequate supply of vitamins, minerals, and nutrients from their diets (micronutrient deficiencies) as well as people who have excessive net energy intake (also called overweight or obesity depending upon the severity of the condition).²⁴ Collectively, this set of problems is often referred to as the triple burden of malnutrition.

The most commonly recognized form of malnutrition is energy deficiency or chronic hunger.²⁵ Around the world, many people are chronically hungry because their diets do not provide enough energy for them to lead active and healthy lives.²⁶ Events in the past few years, including a rise in global food prices and the global economic crisis, have led to dramatic increases in the number of hungry people in the world.²⁷ The Food and Agriculture Organization of the U.N. estimates that for 2011-13 period there were 842 million people who were not getting enough food to lead active and healthy lives.²⁸ The recent food price crisis has been especially impactful, as it has effected all parts of the world at once and thus reduced the effectiveness of international, national, and subnational aid systems and coping mechanisms.

The challenge of malnutrition also includes significant numbers of people who experience micronutrient deficiencies in their diets from a lack of key vitamins and minerals such as vitamin A, iodine, iron, zinc, and folic acid. For example, fifteen percent of people in the world lack adequate iodine, more than forty percent of children under five in the developing world have compromised immune systems as a result of a deficiency of vitamin A, and iron deficiency reduces the health and productivity of forty percent of

²⁴ *Id.* at 187-98.

²⁵ Food and Agriculture Organization of the U.N., *The State of Food Insecurity in the World: The Multiple Dimensions of Food Security* 15 (2013), <http://www.fao.org/docrep/018/i3434e/i3434e.pdf>.

²⁶ *Id.*

²⁷ *Id.*

²⁸ *Id.* at 8.

people in the developing world.²⁹ Less a problem of food availability, micronutrient deficiency is a problem of diet. “Throughout the developing world, the poor live mostly on a monotonous regime of starchy staples to which small quantities of more nutritious foods are added as money and availability allow.”³⁰ While staple foods such as wheat, rice, corn, or millet provide energy (calories), they do not on their own provide enough vitamins and minerals for a healthy diet.³¹

Finally, malnutrition also involves excessive net-energy intake. More and more people are consuming diets composed of energy-dense, nutrient-poor foods while also transitioning to lifestyles that involve lower levels of physical activity than in the past. This global “nutrition transition” means that many nations are now not only confronted by undernutrition, but also by rising rates of overweight and obesity.³² In the United States, obesity rates have increased significantly over a relatively brief period of time. In 1990, no U.S. state had a prevalence of obesity in the adult population greater than fifteen percent.³³ By 2012, no state had a prevalence of obesity less than twenty percent, while thirteen states had a prevalence of obesity equal to or greater than thirty percent.³⁴ Overweight and obesity are not just problems impacting developed countries. For example, a 2014 report from the Overseas Development Institute found that prevalence of overweight and obesity in developing countries has increased more than threefold since 1980, from 250 million to more

²⁹ The World Bank, *Repositioning Nutrition as Central to Development: A Strategy for Large-Scale Action* (2006), <http://siteresources.worldbank.org/%20NUTRITION/Resources/281846-1131636806329/NutritionStrategy.pdf>.

³⁰ UNICEF, *Vitamin & Mineral Deficiency: A Global Progress Report 4* (2004), <http://www.micronutrient.org/CMFiles/PubLib/Report-67-VMD-A-Global-Damage-Assessment-Report1KSB-3242008-9634.pdf>.

³¹ *Id.* at 4-5; *See also* *Repositioning Nutrition as Central to Development*, *supra* note 29.

³² *Repositioning Nutrition as Central to Development*, *supra* note 29, at 24.

³³ U.S. Centers for Disease Control and Prevention, *Adult Obesity Facts* (Sep. 9, 2014), <http://www.cdc.gov/obesity/data/adult.html>.

³⁴ *Id.*

than 900 million people.³⁵ Overweight and obesity have a number of health consequences, including increased incidences of chronic diseases such as type-2 diabetes, cardiovascular disease, and hypertension.³⁶ Discussions about overweight and obesity may be difficult, as they touch on deeply personal issues such as diet, family eating patterns, exercise, and genetic predispositions. However, such discussions, as well as structural changes to improve access and information about food, are vitally important to the health and security of states and people.

III. OPTIMIZING FOOD SAFETY

Concerns about food safety, like many other challenges to global health and security, have become more complex as a result of globalization. The establishment of interconnected food systems that link many people and places began long ago as desire for spices, foods, and goods encouraged the establishment of trade routes. In recent decades, however, advances in transportation and communication have enhanced the speed and scale of global interactions. Like many global systems, from the air transit system to mail and cargo systems, the food system has been transformed by globalization. The modern global food network is designed to move perishable goods rapidly from producers to consumers. Linking local, national, and global food systems has provided tremendous benefits to consumers in terms of availability, variety, and pricing of food. The results of greater connectivity, however, have not been entirely positive.

While the global food network largely provides safe and healthful food, it can also be a means for transmitting threats to human health. The challenge of optimizing food safety involves ensuring that food supplies remain free from threats to human

³⁵ Sharada Keats & Steve Wiggins, *Future Diets: Implications for Agriculture and Food Prices* (Jan. 2014), <http://www.odi.org/future-diets>.

³⁶ Roland Sturm, *The Effects of Obesity, Smoking, and Drinking On Medical Problems and Costs*, 21 HEALTH AFFAIRS 245 (2002), available at <http://www.glahder.dk/engelsk/obesity/obesity%20Roland%20Sturm.pdf>.

health—whether from natural or accidental contamination, such as incidents of contaminated spinach, pet food, milk, peanut butter, and eggs—and also in preventing actors with nefarious intent from using networked food systems to intentionally cause harm (a set of concerns often discussed as food defense). Contamination of food supplies by infectious diseases or chemical hazards can have significant health impacts. Illness and contamination of crops, livestock, and food supplies can also have a significant impact on the cost and availability of food.³⁷

There are multiple ways that food can be impacted by health threats or contamination: crops or animals can be sickened by viruses, fungi, or other microbial threats (such as wheat stem rust or potato blight); food can carry a disease from sick animals to human consumers (such as bovine spongiform encephalopathy/Mad Cow Disease); food may be accidentally contaminated (such as *E. coli* infections in spinach and ice cream); humans can infect a food supply by moving into marginal areas or eating marginal foods (such as the believed transmission pathway of the SARS coronavirus passing from bats to civets to humans); or food can be intentionally contaminated with diseases or toxins (such as the 1984 contamination of salad bars in The Dalles, Oregon).³⁸

Despite national and international efforts to improve food safety, foodborne illness remains a significant area of concern. The globalization of food systems, along with the intensification and increased centralization of agriculture and food industries, has created conditions favorable to the spread of contaminants and known diseases as well as the emergence of new forms of diseases. For example, a 2010 U.S. Government Accountability Office review found that while sixty percent of fresh fruits and vegetables and eighty percent of seafood come from outside U.S. borders, the Food and Drug Administration is able to physically inspect only one

³⁷ FOOD SECURITY, *supra* note 1.

³⁸ *Id.*

percent of imported food.³⁹ The increasing speed and scale of connections between nodes in the global food network means that when problems do develop, they are often widespread and cause illness or death in large numbers of people. In part, food safety threats have such large potential impacts because they can be so rapidly and efficiently diffused via the normal operation of the global food network.

IV. MANAGING GLOBAL ENVIRONMENTAL CHANGE

The ways in which people satisfy their need for food—such as gathering, hunting, farming, fishing, and raising livestock—are significant contributors to the impacts that human populations have on the environment. Agriculture and food production are significant drivers of environmental impacts on land and soil, water use and water quality, and components of large-scale environmental changes such as climate change. Production of food and fiber accounts for seventy percent of water withdrawals and is responsible for thirty percent of greenhouse gas (GHG) emissions.⁴⁰ Globally, agriculture consumes more water (including virtual water that is transported in food) than any other industry and is also the primary source of nitrate and ammonia pollution.⁴¹ Agricultural practices drive environmental changes such as land clearance, land degradation, increased salinization of soils, stresses on water resources, impacts on water quality from agricultural runoff, and the development of antibiotic-resistant microbes.⁴² In seeking to understand the dynamics of global

³⁹ Government Accountability Office, *Food Safety: FDA Has Begun to Take Action to Address Weaknesses in Food Safety Research, but Gaps Remain* 10 (Apr. 23, 2010), <http://www.gao.gov/new.items/d10182r.pdf>.

⁴⁰ World Economic Forum, *Realizing a New Vision for Agriculture: A Roadmap for Stakeholders* 4 (2010), http://www3.weforum.org/docs/WEF_IP_NVA_Roadmap_Report.pdf.

⁴¹ Food and Agriculture Organization of the U.N., *World Agriculture: Towards 2015/2030* (2003), <http://www.fao.org/docrep/004/Y3557E/%20y3557%20e03.htm#c>.

⁴² U.N. Environment Programme (UNEP), *Global Environment Outlook 4: Environment for Development* (2008) available at http://www.unep.org/geo/GEO4/%20report%20/GEO-4_Report_Full_en.pdf.

change, it is vital to recognize that agricultural and food production systems are linked in a series of feedback loops wherein food systems drive environmental changes which in turn impact food systems and leads to further environmental changes and so on.

Collectively, food production activities have had significant, though often unintentional, impacts on the global environment. Environmental changes are often localized, such as cutting down or burning forests to create croplands. The impacts of such changes are often local as well, such as increased erosion of topsoil, loss of soil nutrients, and reducing water quality when siltation and agricultural runoff enter waterways. However, local changes can aggregate to have regional and national impacts that contribute to problems such as toxic dead zones in rivers and oceans, desertification, and global climate change. During the twentieth century, agricultural production came to increasingly rely on mechanization and synthetic chemical inputs including fertilizers, insecticides, and pesticides, as well as scientific techniques to measure soil fertility, acidity, and aid in making adjustments to the nutrition and care of livestock.⁴³ These developments led to significant increases in productivity, but also resulted in a number of unintended consequences such as pests developing resistance to pesticides and herbicides, and negative impacts on land, water, habitat, and biodiversity.

In response to the negative unintended consequences of agricultural intensification—as well as concerns about reductions in productivity gains and rising demands for food—a number of efforts have recognized the need to amplify the positive benefits of intensified agricultural production while minimizing its negative environmental effects.⁴⁴ Managing environmental change in food and agricultural production involves a number of efforts to shift from a vicious cycle of food system-induced environmental degradation by harmonizing food and agricultural production with the imperatives of sustainable development to create a virtuous cycle that enhances

⁴³ GIOVANNI FEDERICO, *FEEDING THE WORLD: AN ECONOMIC HISTORY OF AGRICULTURE, 1800–2000* (2005).

⁴⁴ H. Charles J. Godfray et al., *Food Security: The Challenge of Feeding 9 Billion People*, 327 *SCIENCE* 812 (Feb. 2010).

environmental quality and ensures food security. A global food network optimized around the goal of sustainability could help boost soil fertility and reduce erosion, improve local water quality, reduce runoff, and aid in efforts to mitigate and adapt to climate change by providing buffer zones, sinks to remove greenhouse gases from the atmosphere, and energy from current biological sources to reduce GHG emissions.

V. SUSTAINABILITY, RESILIENCE AND WORLD FOOD PROBLEMS

This article provided an overview of the ways that processes of global change have problematized efforts to ensure that all people have the food they need to live active and healthy lives. A key insight that emerges from this analysis is that food security issues—such as malnutrition, food safety, and global environmental change—must be understood as multi-causal and multidisciplinary challenges. It is also vital to underscore that these core challenges are not separate domains of concerns, but rather are interactive areas of operations. Environmental degradation from climate change, for instance, may increasingly cause humans to seek food sources in marginal areas, thus bringing them into contact with new diseases and increasing their impacts on habitats and species. In addition, widespread malnutrition may weaken a population's resistances to disease, thus making them more vulnerable to the impacts of food-borne illness. Understanding the complex, multi-causal, and interactive nature of these food security challenges identifies important solution sets and reveals the need for better coordination between often-disparate efforts to address core drivers that contribute to food insecurity.

Gaining a better sense of the causes of food insecurity opens up a range of solutions that encompass far more actions than just efforts to intensify agricultural productivity. Ensuring food security will require improving the productivity and efficiency of global agriculture while also reducing the environmental impacts of food production.⁴⁵ Yet, food security also involves confronting social,

⁴⁵ H. Charles J. Godfray *et al.*, *Food Security: The Challenge of Feeding 9 Billion People*, 327 *Science* 812–18 (Feb. 12, 2010).

ethical, economic, and political questions about how food is grown, produced, and consumed. Taking a broad view of the changing food security landscape reveals how each of the sets of concerns discussed here are components of a fundamental question: how do we grow a global food network that is ethically, economically and environmentally sustainable, but is also sensitive to and resilient against converging security threats and vulnerabilities?

In the coming decades, efforts to ensure food security will need to utilize the full range of national capabilities from the state, private, and non-state sectors to confront world food problems. Solutions to food insecurity must come through strategies that are sustainable both for human societies and for the environment on which they rely. A second key goal for food systems is to develop resilience: the ability to absorb and recover from adverse events, whether such events are economic, political, or environmental (or perhaps even a convergence of crises that cascade to have amplified negative effects). As discussed above, while food security is an increasingly global issue, perhaps the key defining feature of the emerging network of global food systems is the lack of a centralized governing authority to systematically govern activities. Growing a sustainable and resilient global food network will also require improving understandings of the changing role of authority and actors in global governance.⁴⁶ Significant amounts of energy, ingenuity, and effort have been applied to global efforts to ensure food security.⁴⁷ Moving forward, there is a need to find ways to enhance efforts in order to effectively address the interactive sets of threats and vulnerabilities that impact the well-being, prosperity, and security of people and nations.

⁴⁶ E.U. Inst. for Sec. Studies, *Global Governance 2025: At a Critical Juncture* 42 (Sept. 2010), www.iss.europa.eu/uploads/media/Global_Governance_2025.pdf

⁴⁷ See, e.g., U.S. Gov't Feed the Future Initiative, *Partnership Updates*, <http://feedthefuture.gov/news-and-events/researchers>.