

HOW TO FEED THE WORLD

Edited by Jessica Eise and Ken Foster

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INTRODUCTION: JESSICA EISE AND KEN FOSTER

By 2050, we will have nine billion mouths to feed in a world profoundly altered by environmental change. How can we meet this challenge? *How to Feed the World* unites contributors from different perspectives and academic disciplines, ranging from agronomy and hydrology to agricultural economy and communication. Hailing from Germany, the Philippines, the U.S., Ecuador, and beyond, the contributors weave their own life experiences into their chapters, connecting global issues to our tangible, day-to-day existence. Across every chapter, a similar theme emerges: these are not simple problems, yet we can overcome them. Doing so will require communication and cooperation between farmers, scientists, policy makers, consumers, and many others.

CHAPTER ONE: INHABITANTS OF EARTH

The population equation is deceptively simple: birth and death. Yet the nuances of population, where it's growing or declining, at what speed, and why, are far more complex. And when it comes to feeding the population, the intricacies skyrocket. Where exactly does the person live and is said individual mobile? Is he or she rich or poor? Young or old? How we confront the uncertainties surrounding future population change underpin the entire food debate. In this critical chapter, Dr. Brigitte Waldorf explores our world's population and answers critical questions about population. To feed the world, what opportunities and challenges face us in the years ahead? What does Earth's growing number of people mean in terms of our ability to feed the world?

Brigitte S. Waldorf

CHAPTER TWO: THE GREEN, BLUE AND GRAY WATER RAINBOW

The small fraction of water that is actually useable for humans is distributed unevenly across the globe. Yet growing demands for water and over-extraction of ground water with little thought to the future are occurring throughout the world. Fortunately, people are waking up to the reality that water is a precious and limited resource and how we manage water resources has irreversible consequences that are easily foreseen yet dire. In this chapter, Drs. Laura Bowling and Keith Cherkauer take a hard look at water. From global conflict, water scarcity, the water footprints of food and more, these two experts guide us through the rivers, lakes, aquifers

and water sources of our world into the dangerous future we face if we fail to use limited water resources wisely.

Laura C. Bowling and Keith A. Cherkauer

CHAPTER THREE: THE LAND THAT SHAPES AND SUSTAINS US

Land is a finite resource, and arable land is even more precious still. There is no more land to be mined, built or bought once we've occupied it all. How we use this precious resource, and for what purposes, plays a critical role in our ability to sustain our world. Today, there is increasing competition for farmland. Yet it's not just use, but quality degradation as well; water availability, fracking, losses of top soil, damage from salinization and more. In this chapter, Drs. Otto Doering and Ann Sorenson take a hard look at the question, will we have enough farmland? Together they explore the historical evolution of land use and the increasing threats we face today, as well as the critical matter of where we can, or might, go in the future.

Otto Doering and Ann Sorensen

CHAPTER FOUR: A CHANGING CLIMATE

If temperatures are too hot, plants and animals as well as the workers tending to them suffer greatly. If there is too little rain, or too much, crops will fail. Climate change is here and we now face these challenges every year as the world breaks its previous record for global temperature. The trend of rising heat-trapping, greenhouse gas emissions is not expected to reverse any time soon. Can farmers adapt to the new climate? Will temperatures continue to rise indefinitely, or is there something that can be done to slow the changes? How will policies affect farming, which is in itself a significant source of greenhouse gases? Drs. Tom Hertel and Jeff Dukes answer these questions and more in this chapter on climate change and its impact on our ability to feed the world.

Tom Hertel and Jeff Dukes

CHAPTER FIVE: THE TECHNOLOGY TICKET

One of the greatest achievements of humanity in the past half century is building the capacity of the world to feed today's seven billion people. This meteoric rise in agriculture also made food more affordable and accessible, lifting millions out of hunger. So what drove this rise in agricultural output? Technological innovation. But this monumental accomplishment did not come without cost. Technology is what enabled us to feed today's population, and it is also the key to developing more sustainable farming innovations and smarter planting methods. Yet there are signs that agricultural productivity growth is slowing and it takes time for new ideas to expand from the laboratory to the field. In this chapter, Dr. Uris Baldos covers the reality of technological innovation and food production from its inception to today. He ends by taking a look at the emerging technologies that can help us attain our goal of sustainably feeding the world.

Uris Baldos

CHAPTER SIX: SYSTEMS

There are lots ways that food can land on your plate. It can be as simple as walking out to your own garden and pulling something off the vine, or as complex as the journey a fresh piece of salmon makes to a landlocked state. Yet it's not just how it gets to you that can differ, but the way in which it was grown. Is it organic? Local? Conventional? Or perhaps GMO? Our food system is complex and diverse, and in this chapter four cutting-edge experts have teamed together to overview how our food finds its way to our plate. Today, many people hold misconceptions about our food production and strong beliefs about how and why it should be one way over another. These specialists take a look at why we have such diversity, and why choice really does matter.

Michael Gunderson, Michael Boehlje, Rhonda Phillips and Ariana Torres

CHAPTER SEVEN: TANGLED TRADE

Unlike manufactured products or banking services, agriculture is tied to climate and soils. The only way certain regions can enjoy fresh fruit and vegetables throughout the winter months is to import products from the tropics or the opposite hemisphere. What's more, international trade is a buffer against unforeseen weather events. Why then is international trade policy so contentious, if it protects us against unexpected weather and gives us what we want to eat when we want to eat it. Opening up to world markets shrinks less competitive sectors and expands those that are more competitive. Yet we don't have a choice if we want to survive in a world of increased interactivity and climate instability. In this chapter, Dr. Tom Hertel covers the nuances of international trade in our food system, the facts and fiction of trade policy, how we can confront these pending changes and more.

Tom Hertel

CHAPTER EIGHT: SPOILED, ROTTEN AND LEFT BEHIND

Food loss, and food waste, are two very different things. One is an unplanned decision made by a well-fed nation of people. The other is a devastating force wrought upon populations who usually can't afford to lose their crops. Food waste happens at the very end of the chain. We buy more than we need and it goes to waste in our grocery stores, restaurants, cupboards and refrigerators. Food loss happens throughout the food chain. It is desperately fought against by farmers around the world. Crops are lost to uncontrolled weeds, bad weather, insect blight, poor storage, forces of nature, poor infrastructure or even unstable political situations. In this chapter, Dr. Ken Foster explores the enormous magnitude of food loss and waste as well as their nuances around the world, the shocking geographical dividers of where each one happens and what we can do to fight against them.

Ken Foster

CHAPTER NINE: TIPPING THE SCALES ON HEALTH

Nutrition is a critical component of the well-being of our population. It keeps us healthy so we can be productive as well as keeping our healthcare costs low. Yet obesity is on the rise and so are the related health problems that come along with it. Many Americans are confused about how they should eat, and eating is not easy when your dinner is supposed to satisfy your hunger, prevent metabolic syndrome and save your community and possibly the world. In this chapter, Dr. Steve Wu evaluates this problem using an 'economic approach' that is simple, clear and concise. He answers: what are the two or three most important drivers of obesity? What are

the tradeoffs of eating healthy? And what is the most efficient way to eat healthy? Choosing what and how to eat is a monumental task.

Steve Wu

CHAPTER TEN: SOCIAL LICENSE TO OPERATE

We don't all see things the same way. For instance, we have different views of animals and we have different views of species of animals. Different cultures view food production issues differently, and even different *people* view food production issues differently. Using our power to revoke and grant social licenses to operate carries consequences. For instance, failure to understand and appreciate differences in opinion and the nuances of a situation has the potential to not just challenge and disrupt trade relations, but also fuel social discontentment. Interrupted trade and social discontent are serious things indeed when it comes to food security. In this chapter, Dr. Nicole Widmar tackles the issue of our power as a society to grant social licenses to operate. Can we do so responsibly and with an attitude of tolerance towards different preferences? Or will we become so stubborn in the righteousness of our beliefs that we disrupt, interrupt and diminish our capacity to feed the world?

Nicole Widmar

CHAPTER ELEVEN: THE INFORMATION HINGE

Communication informs our decisions. It informs how we choose to act and how we wield our power as consumers and members of a broader society. And equivalent to its strength and power is its fickleness and imperfection. Ensuring that we have a reliable and trusted flow of information around the challenges we face to feed the world is, in fact, a challenge in itself. In this chapter, Jessica Eise reviews our current state of communication around food and agriculture, pinpoints particularly stubborn problems and proposes solutions to enhancing our flow of information. Communication is a mighty tool, one we can use well or poorly. It is the hinge upon which decisions, both good and bad, rely. Good communication can yield tremendous progress and, she argues, if we make the effort to both speak and listen carefully about the challenges outlined in this book, we will be well on our way to solving them.

Jessica Eise

CHAPTER TWELVE: ACHIEVING EQUAL ACCESS

Some people spend their days worried about where their next meal will come from. Still others obsess over posting their perfectly composed social media photos of beautifully plated, delicious food. In this world of obvious contradictions, what factors determine who gets to eat what? When nutritious food is inaccessible or unaffordable, what can be done about it? In this chapter, Dr. Gerald Shively takes readers on a tour that stretches from Kathmandu to Copenhagen, and from Caviar to Corn, examining the contributing roles of income, prices and public action in determining the size and composition of someone's next meal.

Jerry Shively