


ANNA LAPPÉ



DIET  
FOR A  
HOT  
PLANET

THE CLIMATE CRISIS AT THE  
END OF YOUR FORK AND  
WHAT YOU CAN DO ABOUT IT

FOREWORD BY BILL MCKIBBEN

BLOOMSBURY

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# DIET FOR A HOT PLANET

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THE CLIMATE CRISIS AT THE END OF YOUR FORK

and

WHAT YOU CAN DO ABOUT IT

ANNA LAPPÉ

With a Foreword by Bill McKibben



NEW YORK \* BERLIN \* LONDON

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For my mother, Frances Moore Lappé, and

my daughter, Ida Jeanette Marshall-Lappé,

and for all the mothers who came before us and

the daughters who will come after.

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~~Like artistic and literary movements, social movements are driven by imagination... Every important social movement~~ reconfigures the world in the imagination. What was obscure comes forward, lies are revealed, memory shaken, new delineations drawn over the old maps: It is from this new way of seeing the present that hope emerges for the future... Let us begin to imagine the worlds we would like to inhabit, the long lives we will share, and the many futures in our hands.

—SUSAN GRIFFIN, environmental philosopher

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## FOREWORD

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Climate change is the biggest thing human beings have ever done; nothing else even comes close. We've already managed to substantially melt the Arctic, to force epic drought, to thaw the high-altitude glaciers that water Asia and South America, all with a single degree of temperature rise. The scientists are all but unanimous in the conclusion that unless we very quickly mend our ways, we will see another five or six degrees' rise before children now in their infancy reach their old age. So we'd better mend our ways.

And as Anna Lappé demonstrates here better than anyone ever has, that means fixing not just our cars and our power plants but also our menus. It stands to reason that the quintessential human activity, agriculture, would play a role in our fate, and as she proves beyond any doubt, that role is large. Livestock alone may account for more global warming gases than automobiles; the entire industrial food system essentially insures that your food is marinated in crude oil before you eat it.

That industrial food system has rarely been more damningly described than in this book—especially the endless spin employed by an army of lobbyists to justify the unjustifiable, to spread doubt where no doubt exists, to undermine the obvious answers that common sense provides. Of course it's a bad idea for the environment for our culture to have evolved a system of monoculture and concentration, of fast food and quick profit. Bad for our bodies, too.

And bad, crucially, for our communities. But this is the hopeful point I'd like to make: A new way of eating will not only mean less greenhouse gases; it will mean more community, and that's almost certainly key to solving the other three quarters of the global warming puzzle. Consider the farmers' market, the fastest-growing part of the American food economy. It's a good idea environmentally: The tomato that travels five miles requires less petroleum than the long-distance traveler. (And tastes better. I mean, think how you feel after a journey of several thousand miles. That's how the tomato feels, too.) But the biggest difference may be the experience of shopping.

When sociologists studied the behavior of customers at supermarkets, they found what we all know: You drop into a trance, visit the routine stations of the cross, and emerge blinking back into daylight with the same bag of stuff you had the week before. At the farmers' market, on the other hand, the average shopper has ten times as many conversations. Ten times! That's one of the reasons people like it. And in a society that's been hollowed out by access to cheap fossil fuel, in the first society on earth where people have no practical need of their neighbors for anything, that's a priceless trait. The farmers' market is the place where community can start to regrow, and hence lay the groundwork for all the other things that need doing: the new bus system, the ride-sharing network, the neighborhood wind turbine.

I remember some years ago, before it was quite fashionable, feeding my family for a year only on food from our valley in Vermont. It required new thinking about cooking—I had a more limited palette to draw on, and hence to please our palates I had to think a little harder. Which was good, but not as good as the fact that I came away from the experience with a whole roster of new friends, the farmers up and down the valley who made each day not just possible but delicious.

That's the sweet world on the other side of the ruinous system we now rely on. Getting there won't be easy—these are entrenched powers, and it will take more than individual actions to uproot them; it will take real political involvement. But food is the right place to begin. Three times a day, we're reminded of what is, and what could be. What *will* be, if we have the good sense to pay attention to Anna Lappé.

—BILL MCKIBBIN

### *Why This Book?*

Sometimes the *Onion* really lands a headline.

Still barely into the research for this book, I stumbled on this one: “Fall Canceled After 3 Billion Seasons.” Yes, you remember fall, don’t you? That “classic period of the year,” the *Onion* quipped, that “once occupied a coveted slot between summer and winter”?

As I was chuckling to myself, I looked out of my window to see November snow slowly drifting downward. It was true. There had been no fall this year. Here in Brooklyn, we had gone from balmy to bitter from one day to the next. If future winters are anything like this last one, daffodils will bloom in Central Park in January.

As more of us have become aware of the climate crisis and its ramifications for life as we know it, these weather reflections have come to seem all the more ominous. And as we have become more aware of the climate crisis, usually dubbed the innocuous-sounding “global warming,” we have come to understand that the future will bring even greater weather extremes, possibly the loss of earth’s climate as we’ve known it.

It is one specific memory, a totem, of the way weather was. For me, it was during a winter more than fifteen years ago. My mother still lived on forty-five acres in southern Vermont in an old barn she had converted into a home—the horse stalls were her library. (The family joke: from horsesh\*\* to bullsh\*\*.)

It was Christmas eve and the snow had fallen in heaps. Born and raised in California, my brother and I, then in college, suddenly regressed at the sight of snow. Decked in our warmest layers, we dashed out of the house, heading straight for an old logging trail on the property. We had a vision: our very own luge run.

The plan was simple and foolproof. My brother would dig; I would be the test pilot. It was a straightforward routine. He carved into soft snow with a red metal shovel, and I sailed down the newly created path. Where my sled flew off, he’d build up the embankment. We continued this way for hours. I would trudge up the hill. Head down the slope. Soar over the not-quite-high-enough edges. There would be more digging, more climbing.

Finally, as the sky darkened through the tall pines, we had the perfect run: a smooth ride down the mountain. All you had to do was hang on, close your eyes, and trust the banks. As night came, we ran into the house to get our flashlights so we could find our way back up the hill after slipping down the mountain sightless.

Christmas morning, my mother got up early, before the rest of us, and sailed through the white, white snow.

It has never snowed enough since in that spot in southern Vermont to repeat the adventure.

I know climate scientists tell us we have to take the long view, not look at changes just over a decade (or even a few). They also tell us we can’t draw conclusions from our personal anecdotes. A sample size of one does not a crisis make. (And of course, the personal story is nothing compared with the climate-change tragedies impacting millions a year.)



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But while we each may have our own story, or stories, collectively we've got more than anecdotes. We've got data. Unless you've spent the past year in a Hummer with the air conditioner on full blast, you know that those scientists who used elaborate modeling to predict climate chaos were on to something. The scientific consensus is that the climate crisis is real—and we humans are responsible.

Virtually every new report paints a more dire picture. New evidence is showing that carbon dioxide in the atmosphere has reached an eight-hundred-thousand-year high, and in mid-2009 Massachusetts Institute of Technology scientists reported that without immediate action the rise of global temperatures in this century will likely be twice as severe as estimated just six years ago.<sup>1</sup>

Perhaps no one feels the impact more powerfully than the farmers. My first research trip for this book took me a short distance from my home, to Glynwood, a farm and education center on 225 acres in New York's Hudson Valley. I got to sit in on a meeting for farmers with NASA's Goddard Institute for Space Studies' Dr. Cynthia Rosenzweig, a leading expert on climate change and agriculture. The farmers were sharing their own stories of change already happening on their farms and were hearing from Rosenzweig about changes yet to come.

I'll never forget the audible gasps from the two dozen New York State farmers gathered on that cold December day when Rosenzweig explained the significance of a slide glowing on the screen in front of them. Pointing to an arrow sweeping south from New York, Rosenzweig said, "If we don't drastically reduce greenhouse-gas emissions by 2080, farming in New York could feel like farming in Georgia."

"It was all projections before. It's not projections now; it's observational science," she continued, adding that we're already seeing major impacts of climate change on agriculture: droughts leading to crop loss and to soils ruined by salt accumulation, flooding that leaves soils water-logged, longer growing seasons bringing new and more pests, and erratic weather shifting harvest seasons.

Researchers recently predicted that by 2100, higher temperatures in regions home to roughly half the world's population—stretching across Africa, India, and southern China and covering Australia, the southern United States, and northern Latin America—will see corn and rice harvests drop by as much as 40 percent.<sup>2</sup> And remember that grain, especially these two, provides almost half the calories human beings eat.<sup>3</sup>

When people think "climate change and food," many go first to exactly what Rosenzweig focused on that day: the impact of climate change on farming. I certainly did. Yet when it comes to the inverse—how the food system itself is heating the planet—a lot of us (that'd be me, too, before this book) draw a blank.

Challenged to name the human factors that promote climate change, we typically picture industrial smokestacks or oil-thrusters on planes and automobiles, not Pop-Tarts or pork chops. Yet the global system producing and distributing food—from seed to plate to landfill—likely accounts for 31 percent or more of the human-caused global warming effect. According to the Food and Agriculture Organization of the United Nations' seminal 2006 report, *Livestock's Long Shadow*, the livestock sector alone is responsible for 14.5 percent of the world's total greenhouse gas emissions. That's more than the emissions produced by the entire global transportation system—every SUV, steamer ship, and jet plane combined.<sup>4</sup> (Emissions from transport represent just over 13 percent of total greenhouse gas emissions.)<sup>5</sup>

Move over Hummer. Say hello to the hamburger.

Asked what we can do as individuals to help solve the climate crisis, most of us could recite these ecomantras from memory: Change our lightbulbs! Drive less! Choose energy-efficient appliances! Insulate! Asked what we can do as a nation, most of us would

probably mention promoting renewable energy and ending our dependence on fossil fuels. Few among us would point to changing the way our food is produced or the dietary choices we make. (Though this awareness, as you'll read in these pages, is starting to spread.)

Unfortunately, the dominant story line about climate change—the sectors most responsible for emissions and the key solutions to reducing those emissions—diverts us from understanding not only how the food sector is a critical part of the problem, but also, and even more important, how it can be a vital part of the much-needed solutions.

If the role of our food system in global warming comes as news to you, it's understandable. We've been getting the bulk of our information about global warming from reporting in mainstream newspapers, magazines, and documentaries. For many among us, Gore's 2006 Oscar-winning documentary *An Inconvenient Truth* was the wake-up call. In concert with this record-breaking film was Gore's train-the-trainer program, which coaches educators to share his presentation, has alerted thousands more to the threat, but offers little help in making the connection between climate change and the food on our plate.

Mainstream U.S. newspapers haven't been doing much better at covering the topic. Johns Hopkins University researchers analyzed climate-change coverage in sixteen leading U.S. newspapers from September 2005 through January 2008. Of the more than four thousand articles on climate change published, only 2.4 percent addressed the role of the food system, and most of those only mentioned it peripherally. Just half of 1 percent of all climate-change articles had “a substantial focus” on food and agriculture.<sup>6</sup>

Internationally, the focus hasn't been that different. Until recently, much of the attention from the global climate-change community and national coordinating bodies was also focused on the energy sector, on coal-fired power plants, and heavy industry—not on food and agriculture.

All this is finally starting to change.

By the second half of 2008, I was beginning to see articles covering the topic in publications that spanned from *O* magazine to the *Los Angeles Times* to *Etihad Inflight* magazine, the first publication to cover my work on this book. (I considered this a great moment of media irony, that the inflight magazine for the national airline of the United Arab Emirates—not exactly an eco-business—would be the first to cover this book on climate change.)

In September that same year, Dr. Rajendra Pachauri, the Indian economist in his second term as chairman of the United Nations Intergovernmental Panel on Climate Change (IPCC), minced no words: “In terms of immediacy of action and the feasibility of bringing about reductions in a short period of time,” said Pachauri in a speech in England, choosing to eat less meat or eliminating meat entirely “is one of the most important personal choices we can make to address climate change.”<sup>7</sup>

By the time I read Pachauri's bold call to action, I had been thinking, talking, and writing about the food-and-climate-change connection for some time, always with three questions in mind: Why does our food system play such a significant role in heating our planet? How can food and farming be part of the path toward healing the globe? And what can we do to be part of the solution? From these three questions, this book emerged... along with a profound sense of hope.

Here's why.

When I started exploring the food system's role in global warming, I quickly realized that, as with many other climate-change conundrums, most of the solutions are known. Yes, every day we're learning more, but the basic directions are clear.

Plus, I had already disabused myself of the idea that our global industrial food system was “working.” For my previous two

books, I'd had to face its failure to nurture healthy people or healthy ecosystems. Now, as I saw the food system's climate cost well, I began to think that just maybe this crisis could provide additional motivation to usher in more sane ways of farming and eating.

As I learned about what a climate-friendly food system looks like, I learned that its methods not only reduce greenhouse-gas emissions but also help us pull carbon dioxide out of the atmosphere. With more than twice as much carbon stored in our soils than in the planet's living vegetation, turning our focus to the soil is critical.<sup>8</sup> I learned that implementing climate-friendly solutions including agroecological and organic methods—creates even more beneficial ripples: preserving biodiversity, improving food security and people's health, strengthening communities, and reducing reliance on diminishing oil reserves. Plus, we create a more resilient food system, one better able to withstand the inevitable weather extremes.

In addition, looking squarely at the intersection of food and climate change offers each of us power, specific actions we can take. We eat every day. (I don't know about you, but I can't say the same for buying appliances, changing lightbulbs, or driving a car.) And possibly most exciting, the focus on food helps us see how the billions of people across the globe who still live on the land—a farmer, rancher, pastoralist, or peasant—are no longer a "problem" to be solved, but among our great, untapped resources in the fight against climate change.

These are just some of the reasons to be hopeful. But this book isn't just about hope; it's also about how we humans have managed to make something that should nourish us—food—into one of the biggest environmental disasters of our era.

In part I, "The Crisis," I share with you how the food on our plates has become such a contributor to global warming and give you a glimpse of the forces pushing us along this climate-destructive path.

In part II, "The Spin," I explore why we've missed this key part of the climate-change story and how the food industry is waking up to the fact that it won't remain out of the climate crosshairs for long. In this section, I take you inside a meat-marketing shindig in Nashville; a Grocery Manufacturer Association conference in a swank Washington, D.C., Ritz-Carlton; and other industry gatherings to share how the industry is framing the connection between the environment and its business. I give you a rundown of the plays from the industry spin book and offer some examples of how the industry is starting to capitalize on the nascent awareness of connections between the food sector and global warming.

In part III, "Hope," I head to the fields. Away from the PowerPoints and media releases, we hear about the solutions emerging from the land: from the soil, the crops, and the farmers who are cultivating a food system that is resilient, restorative, and regenerative—that pleases our sense and senses.

My hunch is that some of you might think this sounds pretty pie-in-the-sky. I've anticipated your skepticism; or, the skepticism you will soon encounter as you begin to talk with others about food and climate change. So, I share tips for confronting the major myths fomented by naysayers, focusing on several core and interlocking ones: the inevitability myth, the false-trade-off myth, the poverty myth, and the prosperity-first myth. I also tackle perhaps the two biggest myths of all: that hunger will be the price we pay if we move away from industrial agriculture and that biotech crops, not agroecological methods, hold our best hope for feeding ourselves in a climate-unstable future.

In part IV, "Action," I deliver a recipe for making change, for what we can do as citizens and eaters. You'll find seven principles for a climate-friendly diet and inspiring stories about going beyond our forks to be part of a global movement that is shifting our planet toward sustainability.

On my first research trip for this book, I got a serious dose of pop culture's take on our doomed future. Over the course of a cross-country trip to Seattle, I devoured Cormac McCarthy's postapocalyptic downer *The Road*. The next night, I stayed up late in my hotel

room watching New York City disappear under ice in *The Day After Tomorrow* and Will Smith defend himself against a world gone mad from a virulent virus in *I Am Legend*. I then curled up with a stack of articles about global warming. As I read, I found all were drumming home the same message: If we don't reduce our greenhouse-gas emissions to 80 percent below 1990 levels, at the very minimum, by 2050, we're in big, big trouble. All of the authors were then quick to add that not only are we failing to come close to this fundamental task, but we're emitting *more*, not less, carbon dioxide every year.

Made me think Will Smith might not have had it so bad after all.

As I sank into these documents, I found myself getting depressed, even getting close to numb. That is, until I turned back to the project—and to food. There is real power in our forks, I've discovered. There is hope here. We feel it once we see ourselves connected to people creating food systems that are nourishing—nourishing for us and the earth. And we feel this connection in one of the most simple acts we perform every day: eating.

No, we need not feel paralyzed by the scale of this unprecedented global challenge. Indeed, by turning our sights to food, we may just find the integrating lens—and grounding source—for bringing to life the real solutions already before us.

I like fall. I've been really missing it here in New York. Now, after uncovering the power of the food system to be a player in redressing the most overwhelming of threats to our species, I think maybe, just maybe, the *Onion* found a good punch line, but not a prophecy.

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## HOW TO READ THIS BOOK

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I wrote this book for anyone interested in the food on their plate and the sky up above. No prior knowledge of climate-change science is required.

I myself am not a scientist. I see my job as distilling insights and analysis from some of the world's best scientists to help you understand these complicated ideas. While I'm at it, I should add: I'm no farmer, either. I relied on the valuable, on-the-lane experience of farmers who shared their experience with me so that I could, in turn, share it with you.

As with many nonfiction works, you can jump in and around this book wherever your curiosity takes you. Along with long chapters, selected sections offer nuggets of info to help you understand the issues and take action. You'll also find a resource guide containing recommended books, films, and Web sites, and a selected bibliography for further learning and ideas to take action.

In addition, the endnotes include all the obligatory info—journal names, Web sites, etc.—as well as suggested additional reading to help you dive in further.

Finally, this book, though printed on immutable paper in permanent ink—is a work in progress. I encourage you to offer suggestions, corrections, or ideas by visiting the book's Web site, [www.takeabite.cc](http://www.takeabite.cc), and getting in touch.

ANNA LAP

*Brooklyn, New York*

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I  
CRISIS

## THE CLIMATE CRISIS AT THE END OF OUR FORK

### **PRELUDE TO A CRISIS: A TASTE OF A CLIMATE-FRIENDLY FARM**

By the time I pull into Full Belly Farm, the rain has started to come down in sheets. I creep down a mud lane, past an orchard—waiting (it's not quite fruit season yet) toward a towering barn, a few houses, and a low-lying office. A two-hour drive east of San Francisco, Full Belly is nestled inside the Capay Valley. A flat, gently sloping depression twenty miles long and a few miles wide, Capay was created by the faulting of the surrounding ridges. Having separated from the coastal range at a glacial pace, it's now a haven to dozens of organic farms.

Lucky for me, I arrive in time for lunch. Before I get my tour of the farm's 250 acres, which will take me to the lambing sheep and acres of walnuts, fennel, broccoli, cauliflower, and some ninety other crops, I get to eat. And eat we do. Today, it's miso egg drop soup with mushrooms, freshly baked bread, hand-wrapped California rolls, and a huge salad with orange slices and goat cheese from down the road. Apparently, the feast is typical. Five days a week, the live-in staff and interns, volunteers, and often neighbors chow down on lunches like this one. Full belly, indeed.

I'm here to see firsthand what a thriving sustainable farm looks like, one that's gotten unhooked from an addiction to the fossil fuels and petroleum-based chemicals that define industrial farms. All while employing as many as sixty people and producing abundant food, every month, directly for the more than fourteen hundred families who are farm members, plus the many thousands more who find Full Belly's food through farmers' markets, restaurants, retail stores, and wholesalers.

This farm is a model of energy thoughtfulness—as opposed to energy-use recklessness. The founders are constantly looking for ways to decrease their dependence on fossil fuels, from experiments with biodiesel to the solar panels they just installed.

The farm is also a model for a thinking farm; it's a work in progress. Since they started it in 1989, the founders, husband and wife Dru Rivers and Paul Muller and Judith Redmond and her husband at the time, Raoul Adamchak, have continued to discover new ways to tap nature's wisdom. Take the sheep.

On my post-lunch tour, Rivers shows me the inner workings of the farm's complex ecosystem. We start with the ewes, and I decide there is nothing cuter than newborn lambs snuggling up to their baa'ing mothers.

The animals began as quasi pets. (Rivers likes to spin wool.) Today, they are vital to what makes the farm work so well. The two hundred sheep have gone well beyond pet status, becoming productive members of the farm. They weed and prep the soil; they fertilize. One day, they'll hang out on a just-harvested field of broccoli, eating what's left—the leaves and stems—and spreading their manure as fertilizer while they do. The next day, they'll be led out to a new and needy section of the farm.

To steer clear of soil-degrading and ecosystem-poisoning chemicals, Rivers and her co-farmers are constantly searching for innovative alternatives such as the alyssum, which they recently learned about. Sown between strawberry rows, this flowering plant attracts beneficial insects that help keep the harmful ones away—by eating them before they cause any damage.

And they keep learning. The Full Belly founders recently set up homes for owls, whose appetite for mice, rats, and gophers do wonders for rodent control. And thanks to advice from the Department of Agriculture's Cooperative Extension and the handiwork

local high school students, the crew was inspired to install nearly a dozen dwellings for bats on barns and buildings across the farm. Now, at dusk hundreds and hundreds of bats cavort through the night, devouring colossal quantities of insects that would otherwise harm the crops.

As I leave Full Belly, I get one last glimpse of Nellie, one of the farm dogs, dashing through a field on the hunt for gopher holes. With my windows rolled down, I hear the birds singing as they dart in and out of the trees. From my rearview window, I spot nineteen-year-old Jonas, the son of one of the farm owners, in his blue raincoat, hunched over a dirt bike, sloshing through the mud beneath the craggy walnut trees.

Navigating through the rain, I'm daydreaming about fuzzy lambs and really good soup when I turn a bend and see it: the Cache Creek Casino. The sprawling complex—casino, hotel, and parking garage—has dark windows that reflect the hovering gray clouds. My curiosity gets the best of me, and I detour into the five-story lot, pulling in between a vehicular California schizophrenia Hummer on one side and a Prius on the other.

As I descend onto the windowless gambling floor, those farm sounds—of buzzing bees and chirping birds, kids laughing and dogs barking—are replaced, faster than you can say, “Ante up,” by the clanking and beeping and whirling of slot machines and roulette wheels. The farm's wet, refreshing rain is swapped for a haze of cigarette smoke. I don't last long.

Back in the car, I turn left onto Winner's Lane—yes, that's what those clever casino builders really named it—and drown out the on-again rain with a local radio station. A familiar tune fills the car. It's the Counting Crows' interpretation of Joni Mitchell's 1977 classic.

“Don't it always seem to go,” Adam Duritz croons, “that you don't know what you got 'til it's gone / They paved paradise and put up a parking lot.”

As I listen to the lyrics, I think about Rivers's husband, Muller, who grew up on his family's dairy farm until he was fifteen, when his parents could no longer keep it. The farm was the last dairy standing in San Jose. Rivers and Muller recently visited the spot. Where forty years ago there was a family farm, there is now a Kmart and a strip mall.

I turn back for one final look at the gargantuan Cache Creek Casino. Paving paradise, indeed.

## **THE BIG PICTURE: THE CLIMATE CRISIS AT THE END OF YOUR FORK**

I started with this story, both the bummer of Cache Creek and the uplift of the farm, because as I sat down to write, I couldn't get the day out of my head. What you're about to read in this opening chapter isn't the good news; it's the bad. Yet as I wrote, my mind kept circling back to the *other* story. I kept thinking about Rivers and Redmond and about farms like Full Belly, thriving even in the face of casino sprawl. I found myself repeating the words of people you'll soon meet: farmers like Mark Shepard in Wisconsin and food cooperative leader Seong-Hee Kim in South Korea, local-food activists like Jessica Prentice and real-food advocates like Tom Galameau. I found myself picturing that thriving farm outside Seoul where I stood with dozens of small-scale food producers from across Southeast Asia as they regaled me with tales of their abundant, fossil-fuel-free farms.

My mind, in other words, was holding two plotlines at once. And we must. The one you'll read first concerns our climate-disrupting industrial food system. But never for a second forget that there is another story, a story that makes up much of the rest of this book. It is of a food system that is tapping nature's wisdom to heal the climate. From the rainforests of Indonesia to the erosion-marked ravines of Oaxaca, Mexico, this other food system is alive and well. It might not register on the S&P 500 or fill the shelves at Walmart, but it is building on the way that billions of people still procure their food and many more will—if together we create the conditions that will allow it. In this story, people are retrieving wisdom we'd almost lost and drawing on new breakthroughs



Over the past seven years, I have had the opportunity to visit farms that embody this other food system, from the picturesque foothills of the Himalayas in India to a postindustrial Brooklyn neighborhood a few miles from my apartment. Visiting these farms sometimes had to pinch myself to remember that we are fast careening in the opposite direction—toward a largely industrialized food system, with its dead-end addiction to fossil fuels and synthetic chemicals. This industrial food system is hell-bent on bigger, faster, cheaper and has rarely had to pay attention to its true costs—to the soil and water, the welfare of the animals, the health of farmers and farmworkers, or the climate.

But increasingly, the world over, people are waking up to the real price of our industrial food system. Thanks to a plethora of popular books and films, including Eric Schlosser's *Fast Food Nation*, Michael Pollan's *The Omnivore's Dilemma*, the 2006 documentary *Food Inc.*, and scientific reports from venerable institutions like the United Nations' Food and Agriculture Organization (FAO), more and more of us are aware of the "dark side" of an industrial food system that has gone global. We're also beginning to comprehend the climate costs.

Today, as I write these words, my memories of Full Belly Farm are still so vivid I can picture the lambs clumsily taking their first steps and taste the savory miso soup. What I dubbed at the time a *sustainable* farm, I now realize is a *climate-friendly* one, a farm that taps natural systems to guarantee that we are all fed—and that our planet stays cool.

In this chapter, I want to help you understand how we've come to be the one species on the planet that has discovered not only how to make itself sick with the food it produces (think exploding rates of diet-related diabetes and obesity), but also how to undermine the very resources on which it depends, particularly a stable climate. I'll help you draw a line between your pork chops and your Pop-Tart, and the rising mercury on the planet's thermometer, taking you through the food chain. It's a chain of events we tend to be blind to when we pull up our shopping carts to the cereal aisle to ponder whether we'll go for Special K or Honey Toasted Oats.

I want to start, though, with a healthy serving of caveats and a dash of definitions. As you read about emissions from the food system, remember that we have much to learn. Emissions from soils, for instance, differ wildly not just from farm to farm but *within* a farm. Emissions from livestock manure fluctuate dramatically depending on, for example, how and where it's stored. Across much of the globe, we also have only spotty data about many aspects of food system emissions. We will need much more investment in life cycle assessments of our food to grasp the precise foodprint of our diet choices.

## ***Getting to Know Your Greenhouse Gases***

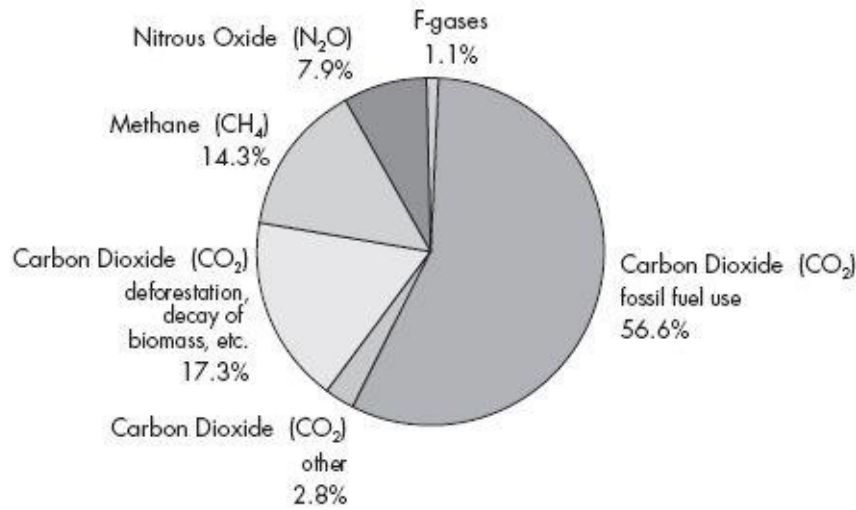
When we hear about global warming we mainly hear about carbon dioxide emissions, for good reason. Human-caused emissions of the gas account for 76.7 percent of all man-made greenhouse gases in the atmosphere.<sup>1</sup> But other greenhouse gases matter, especially two: methane and nitrous oxide, both of which have a direct connection to the food chain, particularly livestock production. Though the livestock sector contributes only 9 percent of global carbon dioxide emissions, it is responsible for 37 percent of methane and 65 percent of nitrous oxide emissions.<sup>2</sup>

One reason these other greenhouse gases are so worrying is their effectiveness in trapping heat—just what we don't want them to do. To help simplify the climate-change conversation, these warming influences are expressed in carbon dioxide equivalence (CO<sub>2</sub>eq) based on the global warming potential (GWP) of each gas over a one-hundred-year period. Methane, for instance, has a GWP of 23, meaning it traps heat twenty-three times more effectively than carbon dioxide over the course of a century. Nitrous oxide has a global warming potential of 296.<sup>3</sup>

## **Share of Man-Made Greenhouse Gases in Total Emissions**

## *in terms of carbon dioxide equivalence*

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*From the International Panel on Climate Change, Fourth Assessment Report, "Synthesis Report"*

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Seems significant, right? It is. But this timescale actually downplays the impact of these gases on our atmosphere today, says Professor of Global Environmental Health at the University of California at Berkeley Kirk Smith. If you consider the GWP of methane during its first five years in the atmosphere, a tonne (metric ton) of methane turns out to be responsible for almost *one hundred times* more warming than a tonne of carbon dioxide. That's because methane breaks down much faster in the atmosphere than carbon dioxide (about eight-and-a-half years compared with many decades), so a shorter time-horizon emphasizes the greater impact of the gas. Indeed, Smith likes to call methane "carbon on steroids."<sup>4</sup>

You'll also hear me talk about the potential for agricultural soils to store carbon, in the form of complex organic compounds and inorganic carbonates. This process, removing carbon dioxide from the atmosphere and storing it as carbon mass in soil, is called carbon sequestration. One tonne of carbon stored in soils is equivalent to 3.66 tonnes of carbon dioxide.<sup>5</sup>

### *Key Greenhouse Gases*

<b>Main Greenhouse Gases</b>	<b>Global Warming Potential</b> <i>relative to carbon dioxide over 100 years*</i>	<b>Percent of Total Emissions</b> <i>expressed in carbon dioxide equivalence</i>
Carbon Dioxide (CO <sub>2</sub> )	1	76.7%
Methane (CH <sub>4</sub> )	23	14.3%
Nitrous Oxide (N <sub>2</sub> O)	296	7.9%
Sulphur hexafluoride (SF <sub>6</sub> )	22,800	Less than 1%
Hydrofluorocarbons (HFC)	As much as 12,500	Less than 1%
Perfluorocarbons (PFC)	As much as 9,200	Less than 1%

\* Global warming potentials from IPCC, Fourth Assessment Report (2007)

*Gases named under the Kyoto Protocol. The protocol established legally binding commitments from signatory governments for reduction of key greenhouse gases.*

**COME OUT, COME OUT, WHEREVER YOU ARE:**

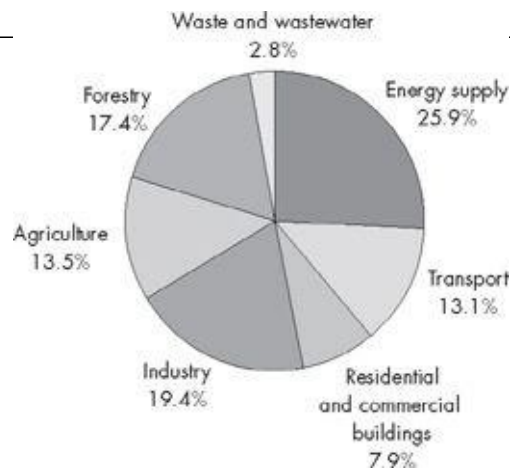
## **THE MODERN FOOD SYSTEM AND GLOBAL WARMING**

In 2007, the Nobel Committee awarded the Peace Prize to the IPCC and Al Gore for “their efforts to build up and disseminate greater knowledge about human-made climate change, and to lay the foundations for the measures that are needed to counteract such change.”<sup>6</sup> About a decade earlier, the United Nations had charged the IPCC with evaluating the risk of human-caused climate change, and the panel’s reports since then have synthesized the state of the science as laid out in peer-reviewed climate-change literature. By 2007, the IPCC had concluded unequivocally that concentrations in the atmosphere of the main greenhouse gases—carbon dioxide, methane, and nitrous oxide—had increased markedly as a result of human activities since 1750. And already we were seeing dramatic climate changes, with ice caps melting at twice the rate that scientists were predicting even a few years ago.

How do the various sectors in our economy rank in terms of worst offenders? According to the IPCC breakdown, 26 percent of total emissions comes from energy supply, 19 percent from industry, 17 percent from forestry, 13.5 percent from agriculture, 11 percent from transportation, 8 percent from residential and commercial buildings, and 3 percent from waste and wastewater.

### **Breakdown of Emissions by Sector**

*in terms of carbon dioxide equivalence*

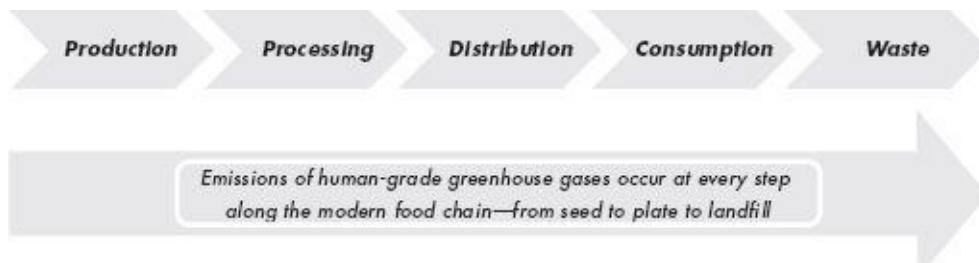


*From the International Panel on Climate Change, Fourth Assessment Report, “Synthesis Report”*

So where’s food?

You couldn’t be blamed for assuming that the food chain, at most, contributes just 13.5 percent of total emissions—that would be the agriculture pie slice. Hiding in the IPCC breakdown, though, are the ways in which the food system is connected to climate change within *nearly every sector of our economy*. Peel the onion of this pie—while you excuse the mixed metaphor—and you’ll see that the food system is, well, everywhere.

### The Food Chain and Greenhouse Gas Emissions



Add all these slivers together—including emissions from the production and distribution of farm chemicals from land as it is transformed to make way for crops and livestock and from energy for factory farms and food processing—and the entire global food chain may account for roughly one third of what’s heating our planet. As I mentioned in the introduction, livestock production alone is responsible for as much as 18 percent of the global warming effect.

These emissions stem from radical changes in how and where we produce food that have occurred just in the past one hundred years—and picking up pace much more recently. There’s nothing “conventional” about this kind of food.

While the abrupt buildup of heat-trapping gases is brand-new, carbon dioxide, methane, and nitrous oxide are natural parts of the carbon and nitrogen cycles in the food system. Since New Guineans developed taro production eight thousand years ago and the Chinese started growing rice four thousand years ago, methane has been released during food cultivation. Since ruminants like cows evolved to chomp grass, these animals have emitted methane in the natural process of digestion. The difference today is in the scope and scale of livestock production—and in crops and animals that are no longer raised within a food system that takes its cues from nature. The consequences have been dire.

In this chapter, I want to help you understand the emissions along the food chain. Though I'll primarily focus on production, which creates the bulk of agricultural and food-related emissions, I'll also trace the stages of processing, distribution, consumption, and waste, and I'll highlight how transportation adds to emissions at each of these stages.

## **FACTORIES IN THE FIELDS: A REVOLUTION IN HOW WE PRODUCE OUR FOOD**

Trace back the roots of the global warming crisis and you'll stumble on the first Industrial Revolution, when coal mining, the construction of railroads, and rampant deforestation triggered colossal emissions of carbon dioxide into the atmosphere. As early as 1896, Norwegian chemist and physicist Svante Arrhenius published the first warnings of these activities' potential consequences, including a planet getting hotter because of human-caused emissions of carbon dioxide.<sup>7</sup> But as we've seen, the buildup of heat-trapping gases really took off only about sixty years later. It was then, in the mid-twentieth century, that agriculture secured its place in the global warming spotlight—as we further tapped fossil fuels to expand food production, especially with the growing use of synthetic fertilizer. Fossil-fuel-based food production seemed ever more appealing after World War Two and the opening of the East Texas oil field pipeline brought oil prices down.

By the end of the Second World War, new technologies—from warplanes transformed into crop dusters to chemical weapons morphed into agricultural pesticides—were further pushing the path of industrialized food. As these technologies, bolstered by government policy, made row-crop farming cheaper and cheaper, the seed of another revolution was born: that of industrial livestock, with their massive animal feedlots.

Most observers of this transformation credit “cheap” grain with inspiring the takeoff of feedlots. But keep in mind that grain's low cost, making profitable its conversion into feed, reflected, and still does, a world of extreme poverty. If the billions of people living primarily on grain have little money to make their need felt as demand in the marketplace, grain can *look* really cheap—especially when its price doesn't reflect the costs of environmental damage.

Together with other dramatic changes in our global food system, these radical and recent shifts have turned the food and farming system, which could, as you'll learn, be a force mitigating climate change, into a key force fueling this crisis.

Sadly, this path could have been avoided, if we'd listened to the many who have anticipated these consequences, including American ecologist Howard Odum. Born in 1924, he witnessed the beginning of the industrial agricultural revolution and was misled. In 1970, he chided “industrial man [who] imagined that his progress in agricultural yields was due to new know-how in the use of the sun.” No, said Odum: “This is a sad hoax, for industrial man no longer eats potatoes made from solar energy; now he eats potatoes partly made of oil.”<sup>8</sup>

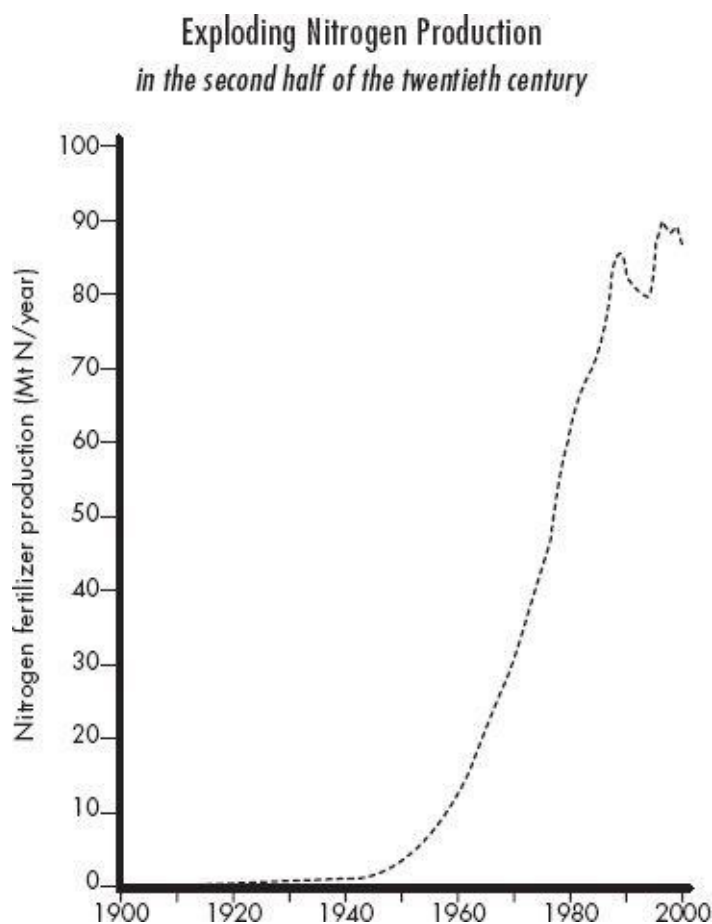
### ***The Story of Soil: Synthetic Fertilizer and Climate Change***

Today is nearly one hundred years from the day a key ingredient of industrial farming got its start. It was July 2, 1909, and chemical giant BASF sent two of its technical specialists, Carl Bosch and Alwin Mittasch, to visit the lab of Fritz Haber, a chemist at Berlin's Kaiser Wilhelm Institute. BASF had heard that Haber was on the brink of discovering a way to transform atmospheric nitrogen into ammonia, an essential component of fertilizer.

According to one account, before Haber could show off his breakthrough, a piece of essential equipment broke.<sup>9</sup> Haber labored through the afternoon and into the night to fix it. By then, Bosch had left in disappointment. The next day, Mittasch—who'd stuck out—was among the first in the world to witness the landmark success. Seventy drops of ammonia a minute started to drip from Haber's invention. A handful of drops of ammonia may sound measly, but it foretold a revolution and BASF knew it. All that was now needed to do was figure out how to scale up—turn drops into tons—and we would have a detour around one of nature's seemingly insurmountable limits: soil fertility.

Since the advent of agriculture, farmers have innovated practices to build soil fertility, from rotating crops and using leguminous crops that naturally bind atmospheric nitrogen, to feeding the soils with plant and animal waste. BASF was seeking a way to industrialize nitrogen-based fertilizer production, making it no longer reliant on these natural farming methods. But this was no small feat. Despite its abundance in our atmosphere, nitrogen gas is challenging to bind into usable nitrogen; it requires just the right catalyst and enormous pressure.

With Haber's invention in his hands, Bosch, the BASF specialist, set to work on figuring out how to scale up. Fast-forward through a half century and a half years and much experimentation later. By the winter of 1913, Bosch's design was producing hundreds of tons of ammonia for fertilizer.<sup>10</sup> (For this and other innovations, both men would go on to earn Nobel Prizes in chemistry and be credited with helping to feed a growing planet.)



*Based on graphic from Vaclav Smil, **Transforming the Twentieth Century** (New York: Oxford University Press, 2006)*

The Haber-Bosch process fundamentally remade farmers' relationship to soil and agriculture's impact on climate. Since the process is so energy intensive—producing just one ton of fertilizer requires as much as thirty-three thousand cubic feet of natural gas—it locked soil fertility into a dependence on fossil fuels.<sup>11</sup> (The discovery had another, much darker, consequence. Ammonia isn't only useful for soils. Ammonia nitrate is also a key ingredient in explosives. So, in a strange twist, it would rewrite the First World War—prolonging the war, resulting in many more deaths. And, nearly a century later, aid the deadly tragedy in Oklahoma City. Timothy McVeigh's bomb used five thousand pounds of it.)

A few words about soil might help you grasp the consequence of what Haber and Bosch came up with. Living far from the land, many of us might think of soil as something inert that holds up plants. Wrong. Healthy soil is alive—a handful hosts billions of living organisms, most too small for us to see. They interact with decaying roots, stems, leaves, and added composting material, such

manure, food waste, and straw. Like a sponge, this healthy organic matter retains moisture and nutrients.

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The organic matter is the key. It prevents the soil from becoming solidified, so that air and water can reach the roots and so the roots can penetrate the soil. Soil's organic matter is also a source of food for bacteria, fungi, yeasts, insects, and earthworms. Without these living organisms, plants can't thrive. These tiny creatures convert unusable organic nitrogen into ammonia and nitrates that plants can use; they "fix" atmospheric nitrogen so it's available to plants and produce acids that make soil minerals accessible, too. Microorganisms also help plants take in critical nutrients, and they prey on disease organisms that might hurt the plants.

Yes, synthetic fertilizer can up yields, but it doesn't build this essential organic matter. Because synthetic fertilizer allows farming practices that don't nurture the soil—fertility is bought, not fostered—industrial farms can neglect the soil and other principles of natural farming, including crop diversity, and still see high yields.

The advent of synthetic fertilizer was just one key in the mechanization of farming that has fostered industrial-scale, energy-intensive farms on a chemical treadmill. As soils are neglected, organic matter degrades, microorganisms die, root systems weaken, and all of which makes soils less able to retain water and crops more vulnerable to drought and disease and erosion, requiring ever more irrigation, pesticides... and fertilizer. By 2008, global production of nitrogen fertilizer had ballooned to 139.8 million tons.<sup>12</sup>

As a result of industrial farms' degraded soils, we're now losing topsoil in the United States ten times faster than nature is making it. We've long known the consequences of lost topsoil, now we know the climate cost, too. As soils are depleted, stored carbon is released as carbon dioxide.

In addition, as nitrogen fertilizer is applied to soils, the fertilizer breaks down, releasing nitrous oxide. Globally, synthetic fertilizer use is responsible for more than three-quarters of agriculture's total nitrous oxide emissions.<sup>13</sup>

In addition to these emissions, consider the climate cost of fertilizer production, mostly reliant on natural gas or, in China's case, coal. China's synthetic fertilizer industry is responsible for emitting 14.3 million tons of carbon dioxide from coal-fired power plants annually, a quarter of the world's total from fertilizer production.<sup>14</sup>

Also, because fertilizer inputs—potash, phosphate, nitrogen—are often manufactured or mined far from where they're used, a transportation emissions into the calculation, too. From net exporter, the United States has become a net importer of fertilizer, bringing in as much as two thirds of the nitrogen, and four fifths of the potash, our farmers use.<sup>15</sup> In 2007, more than half of the potash, phosphate, and ammonia came from just four countries: Canada, Russia, Belarus, and Morocco.<sup>16</sup> (Next time you hear corn-based ethanol advocates celebrate the energy independence we supposedly achieve with their product, remember they're handily ignoring our dependence on imports of the fertilizer ingredients and on the fossil fuel used in producing corn.) On top of this, an estimated half of all nitrogen fertilizer applied to cornfields in the United States is not even taken up by the crop. It is lost through nitrate conversion into gas, by leaching into the soil and our waterways.<sup>17</sup>

Too much nitrogen has simply overwhelmed natural cycles. "We've taken the preindustrial nitrogen cycle and doubled it," says Dennis Keeney, a soil scientist who grew up on a farm in Iowa. "The system isn't set up to keep cycling that nitrogen: it just goes back out again. This shows up as acid rain, nitrates in the water, and nitrous oxide emissions."<sup>18</sup>

Where has this industrial model taken us?

Farmers' yields went up, increasing supply, which has pushed prices down. So farmers have had to produce still more just to scrape by. The already better off grew by squeezing out their neighbors, so that average farm size climbed steadily. In this way, the

industrialization of production has played a key role in making possible an increasingly centralized farm economy—both among farmers and suppliers. And over the past century, U.S. farm policy has only tilted the playing field further to the benefit of a handful of multinational companies, chief among them grain traders ADM and Cargill. The companies are the price makers; farmers are the price takers.

Increasingly dependent on a small number of giant suppliers of agro-chemicals for their growing needs on one side, and giant grain traders to buy their product on the other, many farmers have had little choice but to follow the advice of Nixon's secretary of agriculture, Earl Butz, and "Get big or get out." And here we are today. Large farms, those with sales of at least a quarter of a million dollars—make up only 8.6 percent of total U.S. farms but account for 80 percent of total sales.<sup>19</sup>

Breaking free from this consolidation of power and downward cycle for farmers, the soil, and the climate means a lot of rethinking and remaking of our food system. And now's the time, for this industrial monopoly model, especially its over-production of corn, lies at the heart of two major forces driving greenhouse gas emissions from food: the livestock revolution and the explosion of processed foods.

Before going there, though, let me share with you another technological innovation of the twentieth century that helped spawn this climate-destructive aberration in food production.

## ***Chemical Soup: Agricultural Chemicals and Global Warming***

Remember the German chemist Fritz Haber of fertilizer fame? His inventiveness with ammonia won him a Nobel Prize, but the same genius he'd applied to growing he soon applied to a quite different challenge.

On April 22, 1915, at the dawn of the First World War, the commander in chief of the British army cabled London with troubling news. Pilots were reporting thick yellow smoke billowing from German trenches. "What follows almost defies description," Sir John French cabled. "The effect of these poisonous gases was so virulent as to render the whole of the line held by the French Division incapable of any action at all... Hundreds of men were thrown into a comatose and dying condition."<sup>20</sup>

French's missive was one of the first reports of chemicals used in warfare—in this case developed under Haber's direction. After the war, the use of chemicals that had been developed under wartime mandates was applied to agriculture. The synthetic pesticide DDT, for instance, was used widely during the second half of World War Two to kill typhus-carrying lice and malarial mosquitoes. After the war, it became a popular tool for fending off pests on farms. A few decades later, at the end of 1972, it would be banned in the United States after Rachel Carson's *Silent Spring* popularized its toxicity to wildlife and people.

While DDT is perhaps the most widely known toxic pesticide, it is not the only one, and toxicity is not the only problem many made pesticides pose for our planet. (Don't let the word "pesticide" fool you; the term includes herbicides, fungicides, and other substances harnessed to control pests.)

First, synthesizing these chemicals requires significant fossil fuel energy. Second, the use of chemical pesticides can erode farmers' incentives to rely on agroecological approaches for dealing with pests. Third, the chemical approach to farming allows farmers to plant monocultures—large swaths of land growing just one variety of crop—instead of relying on plant diversity to help address the threat of pests. Finally, keep in mind that most synthetic pesticides are petroleum-based, so factor in the fossil fuel reserves used in these chemicals. While the Environmental Protection Agency estimates that 1.2 billion pounds of active ingredients in pesticides are used annually in the United States—20 percent of the global total—we can only guess at the total volume of petroleum in these pesticides since companies aren't required to divulge the "inert" ingredients in their products.

These are just some of the ways that synthetic pesticides and fertilizers have made agriculture both more susceptible to climate



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