



PART 1

WHY THINK RESILIENCE?

I want to have hope, but I don't know.
There's also the reality of how we're treating
the planet right now. I think we are all going to be a little lost
in the dark as the weather keeps getting more and more chaotic.

— Mary Berry, Southern Exposure Seed Exchange, Mineral, Virginia

Waking Up to Climate Change

MY WAKE-UP CALL on climate change was an actual phone call. It was one of those quiet moments in life that at the time do not feel too important, but looking back is a clear point of change. I remember I was grading papers on a fall afternoon, and gazing out of my office window over corn fields shimmering golden in the setting sun. The phone rang, I answered, and a woman with a snappy English accent explained that she was organizing an event hosted by the local chapter of the American Meteorological Society. “I’m calling to invite you to speak in a public lecture series on climate change impacts in western North Carolina,” she said. “Sure, that sounds great,” I answered. “What would you like me to talk about?” “Well,” she said, “we need someone who is willing to talk about how climate change is changing the way we eat here in the mountains.”

My first thought was that she had the wrong person. I’m a soil scientist, not a climate scientist. On second thought, I wondered what *was* known about climate change effects in food and farming, which was rapidly followed by my third thought: Perhaps this is a good opportunity to learn something new! And so I agreed to do the lecture. We discussed a few details, and I hung up the phone.

I will never forget that call. Thinking back on it now, I remember, in that quiet moment after the call ended that I thought to myself, I guess it’s time for me to learn something about climate change.

Please understand. This was way back in 2008. It wasn't that I didn't know about climate change theory. I knew a lot about it. The Earth's energy balance. The greenhouse effect. The global processes that create weather. How fossil fuel use changes the composition of the Earth's atmosphere. Check, check, check and check—I taught these concepts every year to first-year students in my environmental studies classes. I also knew a lot about the lead antagonists in the climate change story, because I had researched the behavior of carbon and nitrogen in farming systems as a young scientist.

Besides all of that, I was one of those people who estimated my carbon footprint and made lifestyle changes to reduce it. I purchased green products, biked and carpooled when I could and voted for leaders who preached respect for our environment. I joined Transition Asheville and created an energy descent action plan for my community. I was one of the good guys.

Back then, I thought of climate change as something off in the distance—a hazy future threat. I knew it could be bad, but I also believed that we still had time to fix it. I knew it wouldn't be easy, but I felt sure we could and would begin to act on climate change before it caused too much damage.

As I prepared for that public lecture, I was shocked to learn that climate change was already happening, that farmers and ranchers across North America were already suffering increasing losses from more variable and extreme weather. I learned that cities were struggling to manage more frequent and increasingly deadly flooding and heat waves, rising temperatures were beginning to interfere with air travel and tropical diseases were moving northwards. I was surprised to learn that the recent drought I had lived through here in the Southeast was just a glimpse of a future likely to be shaped by increasing competition for water. I was astonished to learn that the Environmental Protection Agency was busy making plans for a retreat from our nation's coasts because of sea level rise. The evidence was clear: the fingerprints of climate change were already touching every part of our lives.

Learning these things changed me. I could not continue to move through a comfortable dream world that put climate change somewhere in the future. I knew that I had to shift my teaching to focus less on the processes of global warming, and more on the reality of climate change: what it is, how it is disrupting land, people, and community and, most important, what we can do about it. I needed to share what I had learned, as well as I could, and in as many places as I could:

- Climate change is happening now.
- Climate change is changing everything.

I needed to do what I could to help people understand that it was way past time for us to think about how we could adapt to climate change even as we worked to slow it down and reverse it.

In the years since giving that public lecture, I went on to lead the development of a national report on adapting U.S. agriculture to climate change, to write a book exploring climate change resilience and the future of food through the adaptation stories of some of America's best farmers, and to resign my faculty position so that I could start a small business helping people take action on climate change.

All because of a phone call one lovely fall afternoon.

Unprecedented

My first big step into the world of climate action came as an invitation to join the U.S. Department of Agriculture (USDA) leadership team responsible for producing the very first national report exploring agricultural adaptation to climate change in the U.S. As a member of the lead author team and the lead scientist on adaptation, I worked with researchers from across the U.S. to gather, review, discuss and report on the state of scientific knowledge about current and future climate change effects on U.S. agriculture as well as effective agricultural adaptation options. It was in this work that I first learned the language of resilience, the ideas and language that I now use every day, ideas like vulnerability, exposure, sensitivity, adaptive capacity, climate risk, and climate equity.

In the 18 months I spent working on the USDA report, I learned many surprising things that caused both heartache and hope in equal measure:

- Climate change is not changing weather patterns uniformly across the U.S. Where you live determines your experience of climate change.
- Climate change is not only increasing the frequency and intensity of extreme weather. Climate change is behind subtle changes in seasonal patterns of temperature and water that rarely make the news, but can be incredibly damaging to agricultural businesses.
- Climate change adaptation is not about figuring out how to adjust to a “new normal.” It is about figuring out how to manage the risks created by more variable weather patterns that are likely to change at a faster pace and grow more intense through at least mid-century.

As the leadership team worked to finish the report, we spent a considerable amount of time identifying the most important lessons learned in our 18 months of work. I want to share one of these lessons here, because I think it expresses very well the unique nature of the climate change challenge to U.S. food and farming systems:

Although agriculture has a long history of successful adaptation to climate conditions, the current pace of climate change and the intensity of the projected climate changes represent a novel and unprecedented challenge to the sustainability of U.S. agriculture.

Many concerns were raised about this statement by the authors and reviewers of the report: that it was too pessimistic; that we were getting ahead of the science; that it was not in the public’s best interest to admit that we didn’t have all the answers. The lead author team pushed back on these criticisms, because we felt confident that the data did support a statement of this nature. We understood it was a provocative statement. We understood that such a conclusion would cause serious concerns about our ability to sustain U.S. agriculture into the twenty-first century. And that’s exactly what we hoped to do. We wanted agricultural leaders to wake up and recognize the unprecedented nature of climate change.

It has been almost a decade since we tried to alert the agricultural community and the general public about the unique challenges of climate change to food and farming. Despite the fact that the scientific evidence and our own lived experience has consistently supported our conclusion since then, we have not yet fully accepted the consequences of our failure to act on climate change.

Consider, just for one quiet moment, the word “unprecedented.” It’s an adjective that means never before known or experienced. Just sit with that idea for a moment: never before known or experienced...

We chose this word carefully and with a lot of intention, because we wanted to be sure that the agricultural community understood the enormity of the challenge before us. We chose the word appropriately. Never before in the entire history of U.S. agriculture have farmers and ranchers managed crops and livestock under these kinds of weather conditions. In fact, if you take the time to look at the Earth’s climate history, you will see that never before in the history of agriculture—never in the 10,000 years since agriculture first began—never before have we been challenged to grow food in a changing climate. It turns out that over the thousands of years we have fed ourselves with farming, our climate has been remarkably stable.

It is difficult to grasp the reality of these times. That the weather changes we’ve experienced in the last decade are going to continue to grow more damaging. That the weather is not going to settle down into some new normal. It isn’t easy to fully understand the fact that spring and fall weather will continue to grow more variable, that both flooding rains and drought will grow more intense and will happen more often, and that record-breaking weather will become common.

It’s even harder to realize what this means for the people who feed us. How will they manage the novel risks associated with changing weather? How will they cope with the additional challenges created by these weather changes: more soil erosion, new pests and diseases, increased competition for water, more frequent and intense wildfires, more labor and market disruptions, pandemics? As I struggled to come to terms with

the unprecedented nature of these challenges, I began to search for what we already knew about managing food and farming systems in highly variable conditions.

Running into Resilience

As the adaptation lead on the USDA report, it was my responsibility to collect all of the science-based information that I could find about the management of weather-related risks in agriculture. I was especially interested to learn what we knew about designing and managing agricultural systems with the ability to thrive under conditions of high uncertainty and change—including more variable weather and extremes.

As I worked to gather this information, I discovered a kind of science that explores the answers to exactly the questions that I thought were important to my work: What qualities of systems allow them to persist over time? How do we design and manage systems to thrive in changing conditions? These are the questions asked by resilience science.

Learning resilience science gave me a way to think more clearly about how agricultural and food systems respond to changing conditions. I learned a new language and new concepts that helped me to slow down, take a breath, and see farming and food with new eyes. For the first time in 20 years of work as an agricultural researcher, educator, policy-maker, grower and activist, I had the benefit of a new language to help me navigate the complexity of food and farming. A new way of thinking that helped me explore with more depth the relationships between landscape, weather, community, culture and politics that shape the day-to-day decisions of farmers and ranchers. To examine more honestly how those decisions enhance or degrade the resilience of their farms, and ultimately our food system. The tools of resilience thinking helped me always keep the whole in mind even as I worked to understand each part.

Here are a few resilience thinking concepts that I have found particularly useful as I've worked to understand the resilience of agriculture and food systems:

- Vulnerability helps to identify threats that have the potential to

disrupt or damage the system and to select effective responses that generate multiple benefits.

- Adaptive Strategy helps to avoid common conflicts that arise between management intention and effect that often degrade the resilience of the system.
- Response, Recovery and Transformation Capacity helps to avoid the common mistake of thinking that resilience is only about bouncing back.
- The Rules of Resilience help to keep in mind three simple rules to guide the design, assessment and management of resilient social-ecological systems.

The most valuable lesson I learned from social-ecological resilience science is that resilience is about a whole lot more than just bouncing back. We can use resilience thinking to cultivate in any kind of system—person, family, farm, city or region—the ability to respond to changing conditions, disturbances and shocks in ways that avoid or reduce potential damage. In other words, we can use resilience thinking to design and manage systems with less need to bounce back in the first place.

Resilience thinking has another gift for us, one that is especially important in this age of climate change. Any time there is a disturbance or shock that causes damage to a system, we can use the rules of resilience to identify options for bouncing forward. Every time a system sustains damage—and there is no doubt that we will experience more and more damaging events in the future—we will have to make decisions about how to repair the damage. In these moments when we will have to decide which way to go, resilience thinking can help us answer the question: “Do we bounce back, or do we bounce forward?”

This is not a trivial question. Strategies focused on rebuilding to twentieth century standards (often called “bouncing back,” and lately called “building back better”) suffer from the same kind of industrial thinking¹ that has created the wicked problems we are struggling to overcome today. Investments made to bounce back use up resources while leaving

us stuck in the twentieth century, despite the growing evidence that twentieth century thinking is what got us into this mess in the first place.

Resilience thinking gives us a new way to think about shaping our world to thrive in change. We can use the rules of resilience to bounce forward to a way of life that recognizes that our well-being depends on the well-being of others and the planet. We can finally let go of industrial thinking and embrace resilience thinking to put us on the path to a resilient future.

Redesign for resilience involves making changes to every part of our society. It requires us to rethink some fundamental assumptions about how the world works—long held assumptions that are the foundation of modern science and technology. It requires that we wake up and confront longstanding structural inequities in our country. It means that we must let go of the toxic beliefs that fueled the industrial era: infinite growth, industrial efficiency, white supremacy, the invisible hand of the market and individualism. It means that we must redefine the meaning of success.

Resilience thinking requires a major shift in at least six major aspects of industrial thinking. I think of these six shifts as design principles that can be used to guide the transformation from our industrial present to a resilient future. These principles are expressed in terms of the current industrial thinking that must change. The list is ordered in terms of how challenging they will be to achieve from least to most challenging:

- From optimum to variable conditions—We must give up the myth that we can expect to create optimum conditions for production and consumption. While it may be comforting, this enduring myth of industrial thinking is especially dangerous given the unprecedented challenges of climate change and other global sustainability challenges.
- From efficient to redundant systems—Industrial notions of efficiency are based on the assumption that the costs of efficiency will be transferred to the public. Industrial thinking does not recognize the indirect costs to society required to support this kind of efficiency, for example public costs of soil erosion, water and air pollution, subsidized crop insurance and climate change.

- From expert to place-based knowledge—Industrial thinking does not honor local ecological, social, spiritual or cultural wisdom; rather it uses expert knowledge to overcome local conditions in a quest for uniformity. For example, the dependence of agriculture on regional water management systems in the northwest, southwest, and southern Great Plains states.
- From industrial to ecological design—Industrial thinking tends to favor simple energy and material flows over more complex flows and cycles. For example, the dependence of agriculture on simplified production settings that receive, absorb and release global flows of fossil fuel energy, fertilizer and pesticides to the environment. We must shift our thinking to focus on the design and management of systems that have the capacity to produce and recycle needed energy and materials.
- From imported to regional resources—Industrial thinking favors the movement of energy, materials, information and wastes through global and national networks. For example, society continues to rely on complex, large-scale networks to meet our needs despite growing evidence of their fragility.
- From extractive to regenerative economy—Industrial thinking ignores the real costs of industrialism’s exploitation of land, people and community. For example, the full costs associated with the global industrial metabolism, such as the industrial degradation of local resources (natural, human, social, financial and built), the reliance on unpaid labor, and the value of non-market exchanges critical to community well-being, are routinely excluded from economic analyses.

A Real-World Test of Resilience

As I began to apply what I was learning about resilience to climate change adaptation in agriculture, I started to see a lot of similarities between the shifts in thinking required to cultivate a resilient food system and the principles of sustainable food and farming. The more I thought about it, the more I began to imagine how I could put the rules of resilience to a real-world test.

After finishing up the USDA report, I planned a project to gather stories from producers using sustainable practices about their experiences farming in a changing climate. Over the next two years, I made hundreds of phone calls and sent out over 400 emails to longtime sustainable farmers and ranchers growing vegetables, fruits, nuts, grains, meats and dairy products across the U.S.

Why longtime producers? Because I knew that climate change effects began to accelerate in the U.S. around the year 2000. I thought that farmers and ranchers who had been farming in the same location since at least 1990 would be the most likely to have noticed this increase in weather variability and extremes.

Why all over the U.S.? Because the changes in seasonal weather patterns associated with climate change were not the same everywhere. The Midwest and Northeast were getting wetter, while the Southwest was getting drier. Average temperatures were rising in most of the U.S., but parts of the Southeast were getting cooler. These different patterns of change meant that farm location was an important factor in how a producer experienced climate change.

Why sustainable? Because I thought that these producers offered three valuable real-world tests of resilience principles. First, environmental sustainability required that these producers use a kind of “ecological logic” in order to create a healthy farm ecosystem that produces crops and livestock with the goal of limiting the import of resources or export of wastes. Second, sustainable producers had been largely left to figure out how to create these systems on their own without the help of “the experts,” so they make an interesting test of the efficacy of place-based knowledge. Finally, I knew that their choice to manage healthy farm ecosystems left these producers ineligible for most of the subsidy programs available to industrial farmers. This meant that they had no choice but to design and manage for resilience just to stay in business—they were farming without a safety net.

And so I got started. Working at night and on weekends over the

winter of 2013–14, I listened as some of the best farmers and ranchers in America shared their experiences of producing crops and livestock in a changing climate. Seven years later I checked back in with these producers to hear how they were doing. I also did some additional interviews with other longtime farmers and some less experienced farmers.

This book is the cumulative result of that work. It is about what I have learned from these farmers and ranchers about real-world resilience thinking, and how I believe their stories can help us bounce forward to a sustainable and resilient food future.

Part 1: *Why Think Resilience?* presents current and projected changes in weather-related challenges across the U.S., explores the unprecedented nature of these challenges, and offers some climate change adaptation concepts that help to clarify options that reduce climate risk and cultivate the climate resilience of land, people and community. Read this section if you want to know more about: specific examples of unprecedented disruptions and shocks associated with climate change; how weather has changed and how it is expected to change over the next 30 years in seven different regions of the U.S.; and a useful new way to think about managing climate risk.

Part 2: *The Rules of Resilience?* takes a deep dive into the principles and practices of resilience thinking applied to the design and management of agriculture and food systems, which are also called agroecosystems or foodways. Read this section if you want to learn more about: the four different kinds of resilience science and which one is most useful to foodways management; social-ecological resilience thinking; some characteristics and behaviors of resilient systems; resilient agriculture design principles; the three rules of resilience; the resilience benefits of sustainable agriculture practices; and some new tools for cultivating resilience in food and farming systems.

Part 3: *What Path to Resilience?* explores the unique potential of resilience thinking to transform the global industrial food system. Read this section if you want to learn more about: the search for sustainable

food in the U.S.; Indigenous foodways; the Good Food movement; the regional roots of resilience; and 12 things that you can do to cultivate a resilient agriculture.

Part 4: Real World Resilience explores climate change, resilience and the future of food through the adaptation stories of bio-intensive, bio-dynamic, organic, climate-smart, and regenerative farmers and ranchers growing vegetables, fruits and nuts, grains, dairy and meats throughout the U.S. Read this section if you want to hear directly from farmers and ranchers about the challenges of growing food in a changing climate, how they are managing climate risk, and how we can help them cultivate the resilience of land, people and community by changing the way we eat.

A Word About Hope

Climate change work is hard. The problem is wicked, the stakes are high, the necessary actions ask a lot of all of us, and if we fail, the future is truly horrifying. People often ask me, “How can you do this work and stay so positive?” I’ll be honest with you. I find myself in some pretty dark places every now and then. Dark places that make it hard for me to continue doing this work. There are a whole host of emotions—anger, fear, regret and grief—that come along with climate change work. They can get in the way of taking action. I’ve seen it in my own work. I’ve watched it shut down the search for solutions in community—from the local to the global.

The enormity of the climate change challenge can, and often does, leave people feeling hopeless. And so I started to dig into hope, to try and understand what it is, what role it plays in our well-being—especially in times of uncertainty and change—and how hope helps us search for solutions in community. I learned that:

- Hope is a verb. It is an action word. It means “to cherish a desire with anticipation.”
- Hope has been studied by psychologists for a long time. They’ve done so much research on hope that “hope psychology” is a recognized specialty.
- Seven kinds of hope have been identified by psychologists, including two kinds that are particularly relevant to climate change work.

The first is a kind of hope called *wishful hope*. This is the belief that somebody else—not you—will make it possible for you to achieve your “cherished desire.” Somebody else—not you—will remove any barriers standing the way to your desire. That somebody else might be a higher power, or a parent, a boss, a scientist, an entrepreneur or a politician. The important thing to remember about wishful hope is that it shifts the responsibility to act onto someone or something else over which you have little or no control.

The really crazy thing about wishful hope is that it is practiced by both optimists and pessimists. Optimists don’t act because they believe it’s all going to be okay in the end. Pessimists don’t act because they believe it doesn’t matter what they do, it is definitely not going to turn out okay. Psychologists say that wishful hope leads to feelings of helplessness, despair and denial. I’d say that there’s too much wishful hope going around these days.

The second kind of hope is called *grounded hope*. This is the belief that in order to realize your cherished desire, you have to work with others to achieve it. It turns out that grounded hope is very much a community-based thing. Grounded hope leads people to get together with others, to visualize a desired future, and then to work together to get there. Psychologists say that grounded hope leads to feelings of personal agency, empowerment and the acceptance of reality.

So now I have a name for the kind of hope I practice, the kind of hope that has sustained me through more than 30 years of work to explore the sustainability and resilience of land, people and community. Learning about grounded hope has helped me understand that everyone, no matter where you stand in the food system, can help put us on the path to a resilient food future.

A good place to get started is to learn about and use resilience thinking—in your family life, in your profession, and in your community. Let’s begin.