

Introduction: Building Resilient Communities Through Food

RESILIENT COMMUNITIES begin with food; they begin with seeds of change.

Imagine a world where no one is starving, where tree-lined streets are filled with mulberries, peaches, and juneberries in the summer, and apples, pears, persimmons, and pawpaws in the fall; where every neighborhood has a thriving community garden; where children collect and trade seeds; and where edible landscaping and bountiful gardens replace lawns.

Imagine a surplus of food, and that children could have access to healthy fresh foods in their schools through school gardens and edible landscaping programs. Imagine if every home could have a front and backyard thriving with edibles and medicinals. What if you were able to walk a few feet out your front door to harvest your favorite seasonal fruits, vegetables, flowers, and herbs. Think of the possibilities if every apartment building had balcony gardens and rooftop gardens. Picture community garden spaces at churches, homeless shelters, and prisons.

Individuals around the world are rising to the occasion of a food revolution as a way of building resilient communities and uniting around the common thread that connects us. We all need food to exist and to thrive. We see

the positive impacts from guerilla plantings in inner cities, urban farms, rooftop gardens, edible food forests in city parks, and neighborhood community gardens. The good food movement is on the rise. This vision is not just one of the future but a fragment of the past that has smoldered in the ashes of the industrialization of the food system — one that is significantly broken, but not beyond repair. There is hope if we take action steps to change the future of food.

Communities, neighborhoods, towns, and cities need advocates, leaders, pioneers, and visionaries all working toward the common mission: growing for the greater good. It doesn't stop at food. We need trees and native plants for the future, as well. Luckily, groups are sprouting up all over with the vision to plant as many trees as possible in their lifetime.

While this may be viewed as a utopian fantasy, it is one practical solution to so many of the threats facing our world today. In permaculture, the problem is the solution.

Let's not forget about the devastation already done. There are ceaseless areas of soil, air, and water contamination from oil spills, radiation, toxic waste, natural gas fracking, groundwater contamination, just to name a few. Fortunately,

individuals like Paul Stamets are bringing their visionary ideas to life through mycoremediation — the process of using mycelium to remediate the environment following the aftermath of deadly environmental catastrophes caused by man.

If we examine a few continents around the globe, we see an unwavering passion for growing gardens using permaculture principles, planting trees and adding mycelium for mycoremediation as a solution to issues of not only hunger but also social justice, environmental issues, poverty, food accessibility, and as a way to bring inclusivity to the community.

North America: a cauldron of biodiversity. From the Pacific to the Atlantic, North America is home to beautiful old-growth forests, prairies, savannas, glades, woodlands, and riparian ecosystems, all of which have an abundance of wild food. From the stunning old-growth trees of the California redwoods to the breathtaking beauty of the mountainous ranges of Colorado and Wyoming, there are individuals and communities planting seeds for the future. From the gorgeous river valleys of the mighty Mississippi to the hauntingly beautiful rolling fog-covered hills of Appalachia, spirited individuals are taking on the role of caretakers for these regions while brainstorming solutions to meet human needs and stewarding the land.

The Gulf Islands of Canada have one of the last remaining Garry oak ecosystems, home to dozens of dwindling species. These islands are rich in biodiversity, especially in the provincial parks and protected areas, as well as local

culture — home to farms, fromageries, wineries, artist communities.

Africa: Home to savannas, deserts, and evergreen, deciduous, and temperate forests. It is rich in biodiversity in flora and fauna but is in danger of habitat loss due to deforestation. According to research done by the University of Pennsylvania African Studies Center in 2011, “Thirty-one percent of Africa’s pasture lands and nineteen percent of its forests and woodlands are classified as degraded. Africa is losing over four million hectares of forest every year, which is twice the average deforestation rate compared to the rest of the world.”¹

Luckily groups are putting solution-based ideas into practice. Gorongosa National Park is one of the world’s most amazing wildlife restoration projects. Over the last two decades, over 4,000 square kilometers have been restored to promote habitat for wildlife and biodiversity.

Australia: Home to permaculture and, according to the Australian Department of Environment and Energy,

home to between 600,000 and 700,000 species, many of which are endemic, that is they are found nowhere else in the world. These include, for example, 84% of our plant species, 83% of mammals, and 45% of birds. Australia’s biodiversity — the plants, animals, micro-organisms and their ecosystems — is threatened from the impacts of human activities. Since European settlement, more than 50 species of Australian animals and over 60 species

of Australian plants are known to have become extinct.²

Europe has been leading the way in banning GMOs, promoting backyard gardens and slow foods for decades. South America continues to transform the land into tropical preserves. We see a rise in the ambition to promote healthy food and clean living.

Carl Sagan once said, “Anything else you’re interested in is not going to happen if you can’t breathe the air and drink the water. Don’t sit this one out. Do something. You are by accident of fate alive at an absolutely critical moment in the history of our planet.”

People in the know are doing their part and inspiring their friends and families. They are causing ripples of change via social media. But unless each of us honestly acknowledges and assesses the negative impact we have on the Earth and actually puts solution-based thinking into practice, we cannot change the future of our home, planet Earth.

Understanding that the soil is a living organism covering the Earth, we then can examine and implement simple solutions in the ways we eat and live that everyone can take part in. It could be as simple as planting more trees, planting an organic garden with native pollinator-attracting plants. It could be as simple as removing a few items from your diet that contribute to soil degradation. It could be as simple as shopping locally or joining a local CSA (community supported agriculture) farm. It could be as simple as taking public transportation. It

could be as simple as buying less. It is up to the individual to be the solution.

Gardening and self-sufficiency are making a comeback, and we are, in essence, getting back to our roots. While local foods may be slightly more expensive, it helps to think of it in terms of spending a few extra dollars per week to reduce our overall healthcare costs and to improve the well-being of the environment. Local foods grown without pesticides help to improve our health and are a viable form of preventative healthcare. Additionally, purchasing sustainably grown food contributes to the future of the planet. Localized food systems significantly reduce the carbon footprint by cutting back on the number of miles that food travels. They also circulate funds back into the local economy. Plenty of farmers markets around the country accept SNAP (Supplemental Nutrition Assistance Program) benefits or food stamps, expanding access for low-income families. Locavores on a budget can join CSA farms and supplement with their own backyard gardens. The rise of food awareness is paramount for our growth as a healthy, sustainable community. Seeing the world from the potato’s-eye view makes us firm believers in the local foods movement as a remedy for the global food crisis.

By teaching and empowering others, especially youth, to grow their own food, we provide them with a sense of purpose, accomplishment, and responsibility. By encouraging them to source food locally, we instill in them a sense of community that fosters respect and commitment, and provides a stepping-stone for them to

tackle other pressing environmental concerns, such as deforestation, global climate change, air and water quality, natural gas fracking, and exploitative extractive industries.

Your Edible Yard will empower each of us to foster a better future, one that can begin with the simple act of growing food in our own yard. By grasping the basic concept of the vital importance of food for humans around the globe, we can begin to understand how to change the world, one small seedling at a time.

Beyond the theoretical, this book will cover basic gardening tips, permaculture projects, and small-scale sustainable farming practices. The book also provides dozens of creative suggestions for encouraging friends, family, and community members in this work. Community gardening, crop sharing, plant sales, seed swaps, guerilla gardening, workshops, and sustainable backyard tours can bond and unite us in achieving these goals.

This book will focus on the importance of ecological growing methods. Organic is better for the environment! Humans had been growing organically up until the 20th century, when chemicals developed in the wake of the two world wars led to the Green Revolution. The Green Revolution was not actually very green, and unfortunately these new growing methods, which quickly became the norm in industrialized nations worldwide, led to a devastating loss of healthy topsoil that had been built up over millennia. Pesticides, herbicides, and fungicides (etc.) contaminate our groundwater with toxins that are harmful to the soil, the water, and our

bodies, especially for children who are particularly vulnerable to toxic exposures.

The Earth's surface is composed of approximately 30% land and 70% water. Soil forms on the land surface and plays a crucial role in supporting life on Earth. Think of the soil as a blanket covering the Earth's land surface, home to billions of organisms, all part of a symphony orchestra that gives rise to life. These tiny unseen organisms assist in soil formation that allows forests to grow and provide structure and nutrients for shrubs, grasses, wildflowers, fungi, lichens, and moss to grow.

The soil is the foundation for life on Earth. It is here that life forms, where flora and fauna thrive, where complex interdependent relationships occur. Soil provides the framework to the mycelium sheath, the network of mycelium that allows for plant communication, nutrient uptake, and soil, and ultimately new soil formation. It takes 500 years for 1.5 centimeters of topsoil to form.

While there are thousands of different soils in the world, their existence is dwindling due to development, monoculture, erosion, clear-cutting, and fracking, among other processes. Monoculture is the production of single crops over large amounts of acreage that leads to the increased usage of pesticides and herbicides. Farmers who grow these crops are often subject to signing a contract to purchase genetically modified (GMO) seed and the chemicals that accompany them. This leads to various major problems, including contamination of soil and water, erosion, a decrease in soil life, a decrease in biodiversity on

that land, and over time, complete degradation of the once fertile land, and the flora and fauna.

Unfortunately, the damage done by these types of farms has already caused a great deal of irreversible destruction to the environment. Fortunately, many large-scale farmers are transitioning to no-till methods, more humane treatment of animals, pesticide-free growing methods, and smaller-scale operations. Joel Salatin has been planting the way by offering practical advice for farmers who wish to make the transition from conventional farming to no-till farming.

The idea of “local foods” began nearly one million years ago with the first hunters and gatherers who ate only what they could find in a 100-mile radius. It is only through the globalization of trade and the development of food industry technologies that the concept of local foods was lost to most of us. The modern local foods movement peaked during the victory garden days of World War I and II when canning and preserving fruits and vegetables was the citizen’s duty to reduce pressure on the public food supply during wartime. It took a long hiatus postwar through the industrialization of mass food production prompted by the modernization of large-scale farming and the introduction of chemical fertilizers and pesticides and inevitably the growth of grocery store chains in the 1950s. Coincidentally, the so-called Green Revolution spawned from the development and production of war chemicals.

Good food requires good soil. Good soil requires worms and a variety of other soil-dwelling organisms and microorganisms to

sprout life from the soil. Soil has been labeled as a nonrenewable resource by many scientists, and therefore, measures must be taken to ensure that the soil that is left on Earth will be preserved and held with reverence. In an article in *TIME* magazine, John Crawford of the University of Sydney estimates that in 60 years the topsoil will be depleted:

Some forty percent of soil used for agriculture around the world is classed as either degraded or seriously degraded, meaning that seventy percent of the topsoil, the layer allowing plants to grow, is gone. Because of various farming methods that strip the soil of carbon and make it less robust as well as weaker in nutrients, soil is being lost between 10 and 40 times the rate at which it can be naturally replenished.³

Further, he concludes that “microbes need carbon for food, but carbon is being lost from the soil in a number of ways — over-ploughing, the misuse of certain fertilizers, and overgrazing.”⁴

If these problems are not immediately addressed, Crawford says two major issues of concern will arise. First, he predicts the loss of soil productivity will result in a 30% decrease in food production over the next 20 to 50 years. Second, he fears water will reach a crisis point, an issue that is causing worldwide conflict.

Citizen gardeners can help build soils and add organic matter back to the Earth through sheet mulching, composting, and no-till methods of gardening.

The best efforts the human race can make are to:

- Stop relying on big agriculture for our food supply. This means altering our diets to eat with the seasons.
- Grow your own fruits, vegetables, and herbs and practice soil-building techniques in the process.
- Leave the soil better than you found it.
- Educate others in your community about the importance of soil building — for the health of the environment, air and water quality, for the health of all life on Earth, from the tiny microscopic organisms beneath our feet to insects, reptiles, amphibians, birds, mammals, and humans.
- Support your local farmers. Join a CSA. Shop at the local grocer or farmers markets. Join a co-op or buying club to source local meats, fruits, veggies, eggs, dairy, etc.
- Become an advocate in your community. Get involved in ways to prevent the depletion of nonrenewable resources.
- Participate in river and litter cleanups.

Another resource-intensive issue is that of manicured lawns. Unfortunately, most landscape companies are not practicing sustainable techniques. With billions of homes in the United States alone, unsustainable front and backyards can truly leave a negative carbon footprint. Pesticide and herbicide residue from lawn applications can be found not only in the soil but also in the water supply and even the air long

after these chemicals have been applied to lawns.

Overexposure to these chemicals has been linked to many life-threatening illnesses, including cancer. It is estimated that there are 40 million acres of lawns in the US and that 30,000 tons of pesticides are sprayed on them annually.

There is no need for chemical applications in your home. Beautiful lawns can certainly be achieved sustainably. Remember that the idea of using chemicals to grow plants is a recent one and came from the ironically named Green Revolution. Transitioning to a more sustainable lawn is a wonderful way to make a green contribution to the future of the planet. Native landscaping will attract pollinators and will make a significant difference in your region's ecosystem.

Numerous sustainable landscaping businesses are popping up across the globe that provide a diverse array of services including, but not limited to, native garden installation, small-scale prairie restoration, rain garden installation, edible landscaping, vegetable garden installation, compost bin installation and education.

Sustainable landscaping services typically landscape with native plants, putting an emphasis on perennial flowers, shrubs, and trees instead of annuals. These companies often follow organic practices and provide invasive plant species removal.

Edible landscaping incorporates fruits and vegetables into the landscape in an aesthetically pleasing way. Landscapers choose the perfect fruits and vegetables for full sun, partial sun, and shady spots throughout a front or backyard and artistically arrange them in a functional and

creative way. Edible landscaping brings sustainability and functionality to life.

A good way to ease into gardening is to start with the landscape. Sustainable, native, and edible landscaping are a few great methods to adopt to get your thumbs green.

In my hometown in Missouri, Terry Winkleman founded a very cool project. The Sustainable Backyard Tour, a St. Louis organization that aims to showcase local sustainable backyards, sets an example for anyone wanting to go green. They focus on those who have replaced invasive and energy-intensive plants with native flowers, shrubs, and trees. They have great ideas for backyard chicken coops, rainwater catchment systems, compost bins, and other urban gardening projects. Visit sustainablebackyardtour.com.

Transitioning to a more sustainable lawn is a wonderful way to make a green contribution to the future of the planet. Native landscaping attracts pollinators and will make a huge difference in your region's ecosystem. Get out and be inspired by individuals in your own neighborhood who have taken a stance to avoid chemicals on their lawn and use sustainable landscaping methods.

Another of my favorite local companies is an inspirational model founded by Joseph Heller after he noticed "a need for sustainable landscape solutions in the St. Louis area." Simply Sustainable Landscaping, owned by Heller and his wife, Brandy McClure-Heller, is solution-focused, based on individual needs and desires. Their services include native garden installation, small-scale prairie restoration, rain garden installation,

edible landscaping, vegetable garden installation, and compost bin installation and education. They landscape with native plants, emphasizing perennial flowers, shrubs, and trees instead of annuals; they follow organic practices, and they remove invasive plant species. Brandy's approach focuses on artistic landscape design and integrating medicinal herbs and edibles into landscapes.

In their collaborative creative process, Joe chooses the plant material and draws a rough sketch of his vision, and Brandy brings the landscape to life in a beautiful artistic rendition. They enjoy creating gardens that are both aesthetically pleasing and functional.

Their top ten favorite full-sun native plant varieties for the Midwest are:

- Missouri evening primrose
- rattlesnake master
- compass plant
- purple coneflower
- Baptisia
- Eastern blazing star
- prickly pear
- smooth hydrangea
- white fringe tree
- bur oak

Their top ten favorite shade-loving plant varieties are:

- Virginia bluebells
- trillium
- May apple

- Solomon's seal
- columbine
- Jacob's ladder
- witch hazel
- flowering dogwood
- sassafras
- pawpaw

Sustainable landscape designers and architects are changing the world one lawn at a time.

Be inspired by the artists, environmentalists, and plant lovers who make this profession their passion. Landscape design is a vast field, with practitioners that focus on many different aspects, including edible landscaping, native/heritage gardens, and pollination gardens. You can incorporate the basic principles of good landscape design into your own home projects, as well as call upon these professionals to help you out.



Chapter 1

The Detriment of the Lawn Obsession

I CAN'T HELP BUT FEEL SHOCKED and a little dismayed when I travel by airplane. While I look forward to getting a window seat and watching the landscape glide by, I often feel an array of conflicting emotions when flying, especially over the US Corn Belt. The patchwork quilt of monoculture corn and soy leaves me deeply unsettled and hopeless. The altitude of the plane provides a big-picture perspective that is hard to capture on land. I begin to contemplate all of the issues surrounding our modern food system. I think about soil erosion and the degradation of our precious topsoil. I think about chemical runoff and subsequent groundwater contamination. I think about the displaced wildlife whose habitats are being destroyed to create ever more farmland and human development. I think about the huge amounts of fossil fuels required to run these industrial machines, all the pollutants released into the air, and the rising numbers of children who struggle with asthma. I look into the clouds and think about the damage done to the ozone layer and the buildup of greenhouse gases in the atmosphere that are causing steadily rising global temperatures.

As the plane descends into the city, I watch as the subdivisions come into focus and am dismayed to see those smooth carpets of

non-native, unproductive, high-maintenance green lawns that so encapsulate the average American experience. As a recent UC Santa Barbara (UCSB) study reveals, the lawn is actually the largest irrigated crop in the United States!¹ UCSB's Bill Norrington summarizes the troubling issue with lawns:

Each year, we drench our lawns with enough water to fill the Chesapeake Bay! That makes grass — not corn — America's largest irrigated crop. Our nation's lawns now cover an area larger than New York State, and each year, we use about 2.4 million metric tons of fertilizer just to maintain them. When there is too much fertilizer on our lawns, essential nutrients are easily washed away by sprinklers and rainstorms. When these nutrients enter storm drains and water bodies, they often become one of the most harmful sources of water pollution in the United States.²

But then I start to think: *this* is where we can make an impact! While changing the practices of the industrial agriculture giants is like turning around a massive cruise ship, we all have the

power to change our immediate surroundings. Those green lawns may be an apotheosis of our culture's distorted relationship to our land, but they also represent a huge opportunity for change. By transitioning our yards from lawn to edible landscapes, we can create positive ecological impacts while building momentum on the local and regional levels for a larger movement toward a truly sustainable and compassionate food system.

I am just one person, and I cannot personally stop this billion-dollar industry. However, I can commit to transitioning to a more ecologically sound way of life by producing food for my family and my community, by building healthy soils and planting polycultures for future generations, and by teaching others everything I've learned in the process. Together, as empowered citizens equipped with the right knowledge, we *can* change the system.

So, what gives? How did this obsession with the perfect lawn and our dependence on industrial agricultural methods come to be? Part one of this chapter explores the history of that exalted green carpet, the unnatural means by which these lawns are pursued and maintained, and the health and environmental consequences of such an obsession. While we've seen a much-needed outpouring of books and articles detailing the negative consequences of chemically sprayed lawns and a cultural shift toward a more natural garden aesthetic emphasizing local ecology and edible food production, chemically sprayed lawns are nevertheless still the norm. The 2018 *Lawn & Landscape State*

*of the Industry Report*³ shows continued overall growth, with lawn care/chemical application as the most popular service for lawn and landscape contractors surveyed. Unfortunately, this very necessary cultural shift is actually inhibited by outdated municipal regulations that favor precisely trimmed green grass over more ecologically healthy and productive gardens. Cultural resistance and status quo attitudes around what a yard "should" look like also play a significant role.

Part two of this chapter provides a brief treatment of these laws, promising stories of grassroots action leading to legislative and cultural changes, and ways we can beat this outdated and unhealthy system through individual and collective action.

A BRIEF HISTORY: THE (NOT-SO) GREEN REVOLUTION

Would you believe me if I said that lawn grasses are not native to this continent? The mowed grass lawn may be a uniquely American preference, iconic of suburbia, but is only made possible with grass species imported from Europe coupled with technological tricks such as the lawn mower, the rubber hose and sprinkler system, and commercially available fertilizers, pesticides, and herbicides. All these are necessary to keep these non-native grasses alive, thriving, and weed-free from sea to shining sea. In fact, the native grasses of the East Coast, which dominated the landscape when European settler-colonialists arrived, were mostly annuals such as broom straw, wild rye, and marsh grass, all of which were considered by the

newcomers to be markedly inferior to pasture grasses of Northwestern Europe. Settlers' animals quickly destroyed most of the native grasses, and European and African grasses slowly replaced them. Most people began to assume the new grasses were indigenous. Even Kentucky bluegrass finds its origins not in Kentucky at all, but Europe or the Middle East!⁴

Lawns first appeared in residential gardens in England and France but were quickly imported by wealthy American landowners who learned about European landscape trends through reading or travel. Those without the funds to travel also saw the expansive green turf lawns through imported English landscape paintings depicting picturesque garden estates. This fashion of trimmed lawns, combined with the 19th century pastoral notion that good health and moral character, often religious in essence, was cultivated by open space, fresh air, and tasteful greenery, led to an anti-urban attitude that was more about order and social status than it was ever about going back to the land or preserving nature.

As Virginia Jenkins puts it, "Single-family houses set in their own gardens were seen as moral bastions of the nation in opposition to the corruption of the cities."⁵ Over time, the front lawn became cemented into American society as a symbol of social status and moral character. "Lawns," notes *Atlantic* journalist Megan Garber, "originally designed to connect homes even as they enforced the distance between them, are shared domestic spaces. They are also socially regulated spaces. Lawns ... have doubled as sweeping, sodded outgrowths of the

Protestant ethic."⁶ Not to mention a form of highly conspicuous consumption, as lawn maintenance was expensive and time-consuming. Lawns owe their widespread existence to a number of factors, but their cultural significance can be attributed to aesthetic movements promoted by the Garden Club of America and early influential landscape theorists and designers such as Frederick Law Olmsted and Andrew Jackson Downing whose landscape theories were modeled on the English country estate. Through this lens, the disproportionate energy and effort families have put into their front lawns begins to make more — or less — sense.

But the American lawn as we know it today couldn't spread to every subdivision in America without socioeconomic factors as well: the growth of the middle class, suburban migration patterns like white flight, and the development of a mass-produced lawn care industry made possible by developments in chemical and mechanical engineering.

Many of the pesticides, herbicides, and fungicides in use today were developed in a period misleadingly referred to as the Green Revolution. It's difficult to overstate how important the period during and after the two world wars was to the rapid rise in practically all areas of the US economy: manufacturing, agricultural technology, weapons development, and so forth. A great sense of pride in nation and the forward-thinking optimism of modernity suffused the era's considerable developments. The US military, as part of postwar science funding programs, sponsored much of the research that

led to the development of pesticides, herbicides, fungicides, etc. At the time, these developments were thought to be harbingers of a great new era of progress and equity. The efficiencies created by electric and gas-powered machinery, breeding technologies aimed at improving crop resilience and yields through genetic engineering, and the production of synthetic nitrogen fertilizers and targeted chemicals that allowed yields to flourish led to a faith in the inherent goodness of these developments. Part of this faith was, of course, due to heavy lobbying by the newly profiting chemical engineering and industrial agriculture industry.

Just think! More variety would improve the nation's health and standard of living. Higher yields of staple crops at lower costs could end world hunger. Everyone could go to the supermarket and get whatever they fancied whether it was in season or not. A good life for all!

Unfortunately, the reality is not quite so simple — nor so good. The ecological effects of the Green Revolution very quickly caught up to us, and it was only seventeen years after World War II that Rachel Carson shook the nation with the publication of *Silent Spring*, giving birth to the modern environmental movement and leading to the creation of the Environmental Protection Agency. With her thoroughly researched exposé on the effects of indiscriminate pesticide use, a national consciousness about the devastating and counter-productive effects of these chemicals was born. Unfortunately, industrial agriculture only grew, and now, as Carson predicted, we are dealing with far worse and far more widespread problems.

While the Green Revolution may have begun as a way to help feed the world, it evolved into something very different. Wouldn't it have been easier to pass laws requiring people nationwide to have space to grow their own food? For over five decades, junk food, convenience foods, and prepackaged meals made their way onto kitchen tables around the world, and unfortunately that trend only grows as people get busier. Gardens were replaced with lawns. Real fruit was replaced with artificially flavored vacuum-packed fruit cups swimming in syrup. Home-cooked meals were replaced with Hamburger Helper or a stop at the drive-thru. Commercials targeted women in the workforce, advertising promises of affordable and convenient meals for busy families.

Below I will summarize the major issues relating to the environmental and human health effects of industrial agricultural methods used in residential lawn and garden care. However, I strongly recommend following up with some more research of your own. Knowledge is power, and this is life-or-death stuff! Empowered, knowledgeable citizens taking political action in their communities and inspiring others is our best way forward.

ENERGY REQUIREMENTS FOR LAWN AND LANDSCAPE MAINTENANCE

A tidy lawn requires frequent mowing, often from a gasoline-powered mower. If you use a push mower, you can avoid the nearly 400 pounds of CO₂ emissions per year for a quarter-acre yard, a typical American lawn size,⁷

while also getting exercise. Of course, using a push mower on a large yard would quickly become a tiresome effort, so it's no surprise that many people opt for riding lawn mowers. Many people are practically driving minicars to keep their expansive lawns in order! In fact, in the 1950s, riding mowers were promoted as sports cars for the lawn.⁸ Electric lawn mowers, often used for small to medium-sized lawns, will cut greenhouse gas emissions and are a cleaner choice overall. Many Americans also use power trimmers, edgers, and leaf blowers, which can be fueled by gas, battery, or electricity. Today, lawn mowers account for approximately 5% of the nation's air pollution!⁹

All of these power tools appeal to consumers for the perceived convenience and were created out of a culture that looks at short-term efficiency and ease over long-term distributed effects. Examine the big picture, and you'll see it is vastly more efficient to opt for a low-maintenance or, better yet, a productive edible yard instead of the expanse of flawless green lawn in the first place! Plus, letting yourself sweat a little by gardening improves physical *and* mental health.¹⁰

ECOLOGICAL EFFECTS OF AGRICULTURAL CHEMICALS

Typical features of a residential lawn care regimen are pesticides and fertilizers (from here on "pesticides" will refer generally to pesticides, herbicides, fungicides, and insecticides unless otherwise noted). Think about it: Pesticides are literally meant to kill living things! Though they are developed to target particular species (weeds

and pests) while preserving what we want (usually turf grass on lawns or genetically modified soy, wheat, corn, and cotton on industrial farms), their harmful effects are typically not limited to its target. Pesticides range in toxicity, and organic pesticides are a less harmful option for organic garden care. But without adequate knowledge, most Americans still rely on conventional means of keeping their lawns green and tidy, so much so that 30 thousand tons of pesticides are sprayed on roughly 40 million acres of lawns in the United States alone every single year.¹¹ And this is tiny compared to the load carried by commercial farms. Between 1987 and 2016, annual US farm use of glyphosate alone grew from less than 11 million pounds to nearly 300 million pounds.¹²

When you spray a lawn with pesticides, you might rightly think it will just, you know, stay on the lawn. Unfortunately, that's rarely true, and small amounts will leak into the larger environment. Plus, most homeowners lack the finesse of agricultural specialists and vastly overuse pesticides due to bad timing and lack of knowledge about proper application. Pesticides and synthetic fertilizers contaminate our groundwater, expose our skin and sensitive organs to short- and long-term health risks (of which children and the elderly are particularly vulnerable), pollute the air, and affect local and regional ecologies by upsetting nutrient balances and harming wildlife. Many Americans are unaware of these harmful effects because the burdens of these toxic exposures are unequally borne by those who cannot choose to live

or work far from these toxic industrial farms. Another major issue is a lack of government funding or resources to assess the actual environmental and health effects of pesticides in the environment, meaning much is unknown about the risks of widely used chemicals such as glyphosate, sold commercially under the Monsanto brand as Roundup. You might even have Roundup in your garage, as it is the second most widely used US lawn and gardens weed killer.¹³

The environment is an open system of nutrient and water cycles. All of the nutrients, minerals, and human pollutants in the air, soil, and water flow in and out of different ecological systems. Agricultural inputs are difficult to contain within the confines of a farm or residence. They move through the soil into the groundwater and into streams and rivers. They are carried by the wind and pollute the air with greenhouse gas emissions or toxic particles that get into our lungs as we breathe. They build up in the environment across the food chain in a process called bioaccumulation. If you take nothing else away from this chapter but that everything is ecologically interconnected, I will be satisfied!

The 2018 USGS National Water-Quality Assessment Project Report sums it up quite nicely: “Most historical and current water-quantity and water-quality impacts from agriculture are the result of the modification of the natural water flowpaths and (or) the use of chemicals.”¹⁴

Agricultural effects on water quality can occur at local, regional, and national scales. For example, increased levels of

nutrients from agricultural fertilizers can stimulate algal blooms and affect the ecology of local streams. Nitrate and some herbicides can move through the soil to groundwater and, eventually, to local streams. Farther downstream, these elevated nutrients can increase costs associated with treating the water so that it is suitable for drinking. Ultimately, chemicals associated with agricultural activities (such as nutrients, pesticides, antimicrobials, and trace elements) and sediment (eroded soil) empty into our estuaries and can harm valuable commercial and recreational fisheries. Elevated nutrient inputs stimulate harmful algal blooms along the Nation’s coasts causing negative economic impacts.¹⁵

How agricultural chemicals specifically affect and contaminate local water systems is highly dependent on the local hydrology, which is the structure and flow dynamics of the water features. Take some time to learn about your local hydrology, both directly on your property as well as in your city and region as a whole, to better understand how agricultural chemicals interact with the water table.

HUMAN HEALTH EFFECTS OF AGRICULTURAL CHEMICALS

The chemicals in many EPA-approved pesticides have been linked to cancer and other diseases. According to the Pesticide-Induced Diseases Database created by the Beyond Pesticides

organization: “The common diseases affecting the public’s health are all too well-known in the 21st century: asthma, autism and learning disabilities, birth defects and reproductive dysfunction, diabetes, Parkinson’s and Alzheimer’s diseases, and several types of cancer. Their connection to pesticide exposure continues to strengthen despite efforts to restrict individual chemical exposure, or mitigate chemical risks, using risk assessment-based policy.”¹⁶ Some of the same chemicals that were used to defoliate forest and farmland under the Herbicidal Warfare Program during the Vietnam War were later used in herbicides and pesticides and sold to consumers.

In March 2015, the World Health Organization’s International Agency for Research on Cancer declared glyphosate, the primary ingredient in the popular weed killer Roundup, a “probable human carcinogen.”¹⁷ Glyphosate’s widespread use on genetically modified seeds — nearly all US-grown corn, soy, and cotton are treated with glyphosate — has been linked to antibiotics resistance¹⁸ and hormone disruption.¹⁹ Despite our high exposure levels from lawn care, living near farms, or eating/wearing crops treated with glyphosate, the chemical is not included in US government testing for pesticide residues on food crops or human bioaccumulation in blood and tissues, and there isn’t much comprehensive information about its effects on human health. Industry representatives, such as Monsanto, the American Soybean Association, and the National Corn Growers Association, have tended to decry the

research that has been done as inconsistent with their own safety assessments.

According to research summaries from Beyond Pesticides, a Washington, D.C. based nonprofit,

Of the 30 most commonly used lawn pesticides, 17 are possible and/or known carcinogens, 18 have the potential to disrupt the endocrine (hormonal) system, 19 are linked to reproductive effects and sexual dysfunction, 11 have been linked to birth defects, 14 are neurotoxic, 24 can cause kidney or liver damage, and 25 are sensitizers and/or irritants. Of those same 30 lawn pesticides, 19 are detected in groundwater, 20 have the ability to leach into drinking water sources, 30 are toxic to fish and other aquatic organisms vital to our ecosystem, 29 are toxic to bees, 14 are toxic to mammals, and 22 are toxic to birds.²⁰

The big unanswered question is the potential health effect of low levels over extended periods of time. Despite a lack of comprehensive research, we would do well to remember a fundamental tenet of environmental policy: the precautionary principle. As defined by the authors of a paper published in *Environmental Health Perspectives* in 2001, the precautionary principle “has four central components: taking preventive action in the face of uncertainty; shifting the burden of proof to the proponents of an activity; exploring a wide range of alternatives to possibly harmful actions; and increasing

public participation in decision making.”²¹
Sounds like sound advice!

POLLINATORS AT RISK

Bees, birds, bats, butterflies, beetles, and other pollinator animals sustain our ecosystem and food supply by helping plants reproduce.

Pollinators are thought to be responsible for one third of our total food supply. Pollinators bring us fruits, vegetables, nuts, oils, fibers, and other raw materials. They help prevent soil erosion and increase carbon sequestration. Between 75% and 95% of all flowering plants on Earth need pollinators.²² Thus, we need pollinators. It's as simple as that.

Pollinator populations are at risk or in decline, mostly due to habitat loss and fragmentation. Pollution, pesticide poisoning, and climate change are also significant factors in population loss. We have seen severe honeybee hive losses known as colony collapse disorder (CCD) across the United States. Many point to pesticide regulations that fail to take into account sublethal effects of these agricultural chemicals on nonhuman species such as insects as a major cause of CCD. Toxicity of chemicals is relative, and it would make sense that a small animal such as a bee would experience pesticides in the environment differently than large animals like humans do. While it remains somewhat of a mystery exactly what is going on with CCD, ecologists do have very clear recommendations for helping our pollinator friends. Plant a pollinator garden, stop using toxic pesticides, include the birds and bees in any land use

plan from residential to commercial, support local beekeeping operations or start a small honey operation in your own backyard, and get involved in public awareness campaigns around pollinator issues.

WASTING WATER

Just as most Americans overuse pesticides, they also overuse water. The average American family devotes about 30% of their total water consumption, approximately 320 gallons a day or 100 gallons per person, to residential outdoor uses, mostly for landscape irrigation, as well as washing cars, swimming pools, and cleaning sidewalks and driveways. Turfgrass receives the highest percentage of irrigation water. Planting natives, mulching regularly, installing rain gardens, and composting to create healthy soils all reduce typical water requirements. According to the EPA, some researchers estimate that more than half of commercial and residential water use is actually wasted due to overwatering, leaks, and evaporation/wind.²³

ERODING TOPSOIL

I've saved perhaps the scariest issue for last. The topsoil is not just *dirt* — it is a fertile, living thing, and it is an important part of what makes vegetation possible. Alive with trillions of microorganisms, mycorrhizal fungal networks, and crawlies like worms, the topsoil provides essential nutrients to plants. Not just agricultural crops, but all plants! The Earth is covered with an average of three feet of topsoil, but that quantity is rapidly declining due to soil erosion,

which is caused largely by industrial agricultural methods. Topsoil erosion decreases crop yields and crop health. It also increases water requirements as the soil cannot store as much water. Compound this with decreasing access to freshwater and a rapidly increasing human population, and Houston, we have a problem! How much topsoil is eroded is dependent on weather, surface topography (the steepness of the slope), and what plants are growing on the soil.

Soil does erode and replenish naturally. However, the rate of replenishment is approximately one to two inches every several hundred years, and the rate of erosion is far outpacing the rate of replenishing. A Cornell University study compiling statistics from more than 125 sources warns of “slow, insidious” soil erosion that “nickels and dimes” us to death. Here are some of its troubling statistics as reported by *Cornell Chronicle’s* Susan Lang:

- The United States is losing soil 10 times faster — and China and India are losing soil 30 to 40 times faster — than the natural replenishment rate.
- The economic impact of soil erosion in the United States costs the nation about \$37.6 billion each year in productivity losses. Damage from soil erosion worldwide is estimated to be \$400 billion per year.
- As a result of erosion over the past 40 years, 30 percent of the world’s arable land has become unproductive.
- About 60 percent of soil that is washed away ends up in rivers, streams, and lakes, making waterways more prone to flooding and to contamination from soil’s fertilizers and pesticides.
- Soil erosion also reduces the ability of soil to store water and support plant growth, thereby reducing its ability to support biodiversity.
- Erosion promotes critical losses of water, nutrients, soil organic matter, and soil biota, harming forests, rangeland, and natural ecosystems.
- Erosion increases the amount of dust carried by wind, which not only acts as an abrasive and air pollutant but also carries about 20 human infectious disease organisms, including anthrax and tuberculosis.²⁴

We all have a role to play in changing the future of our planet, and we all need to keep pushing ourselves to do more. Though the majority of impacts, like from industrial farm operations, may feel beyond our control, what we *can* control is what we do in our own homes. Get rid of that lawn, go organic, and grow some food!