

# FOREWORD

## by Penny Livingston

When I first met Erik in 1999, he was only 19 years old—one of my students at the Occidental Arts and Ecology Center, sitting among an exuberant bunch of enthusiastic young people ready to redesign the world, starting with the community of Sebastopol. He arrived as a part of Planting Earth Activation (PEA), a group that had been installing free gardens for interested community members.

Four years earlier, I had started a permaculture design and building company focused on designing landscapes and human settlements that have the stability and resiliency of a natural ecosystem. I was looking for people to work for me who loved working the land, enjoyed place-making, installing gardens, and building soil.

I was so impressed by the energy of this small but mighty group, eager to create positive change in their community. Of the group, Erik caught my eye for his vibrancy and his moving stories about how such generous offerings had affected the recipients of these gardens. Seeing in him a capacity to bring people together and get things done, I asked him if he was interested in getting paid to do this work and if he could organize his friends to work for me. I chose Erik because I saw in him a young man who embodied leadership with the Seven Sacred Attributes of the Lakota tradition, as told to me by my elder friend, Gilbert Walking Bull. These are qualities the clan mothers in his community would look for in young boys and men to decide who would make a good chief. I have been given permission by Gilbert Walking Bull to share these sacred attributes with others to help us learn and grow our leaders:

1. *Wowah'waka*: Inner quietness, sacred silence.
2. *Wocanto'knake*: Heartfelt love and compassion for all two-leggeds, being a caretaker of people.
3. *Wowausila*: Heartfelt love and compassion for all of creation, being a caretaker of the creation.
4. *Wowawokiye*: To be truly helpful; to discover our gifts, purpose, vision, and to follow through on it. Translating love and compassion into action.
5. *Wobliheca*: The experience of being fully alive and elated, enjoyment of each moment of life.
6. *Wowiyuski*: Positive powers; overwhelming, heartfelt joy; the childlike state of wonder and delight.
7. *Wozani*: The sacred state of health—soundness of mind, body, and spirit—the quickness of a coyote.

When Erik became my apprentice, I put him to the test. I wanted to see what this dynamic young man was made of. He showed up, worked hard, and was passionate about working the land and creating abundant landscapes. He passed every test I subjected him to.

When he was assisting a permaculture design course I was teaching in a very remote rural community in Northern California, I told him, “We need a pile of rocks for a hands-on project by tomorrow afternoon.” Without batting an eye, he told me he had noticed a big pile by the side of the road a mile away. I knew that pile was there and simply wanted to see if he had noticed, and indeed he had! Part of our skill building is to learn to be resourceful by gleaning resources from nearby. In every task I put forward for Erik, he showed up with integrity, enthusiasm, and competency.

Over the years, I witnessed Erik growing into a dynamic, visionary leader, developing the skills and capacity to manifest his dreams and visions. He approaches land management from a spiritually connected intention, working in harmony with the earth, designing and implementing landscapes that the land is calling for. He has developed a gift and a skill for this art, along with a storytelling ability that leaves people with a sense of possibility and inspiration—he frames a story so that people can see themselves in it.

In 2001, I cofounded the Regenerative Design Institute (RDI) at the Commonweal Garden in Bolinas, California, to offer permaculture education to those who have an interest in this approach to design, land management, nontoxic building, and community organizing. We look to the natural world to discover nature’s operating principles and learn from the deep and ancient wisdom it has to offer. At the garden, Erik taught hands-on practical skills with me, like how to properly plant a tree, how to lay out level water-harvesting ditches on the land, how to install irrigation systems, how to make good compost, and more. In 2005, Erik started a successful ecological landscaping business called Permaculture Artisans. As a designer, I felt complete confidence in recommending him to any client because I knew he would deliver quality service with integrity.

By 2012, he had developed a center for permaculture education and demonstration in Sebastopol, California, called Permaculture Skills Center. This center has inspired and trained hundreds of people in permaculture farming, landscaping, and earth-repair techniques. In 2015, Erik started the Ecological Landscape Immersion Program to teach others how to regenerate healthy ecosystems in the landscape design and implementation process. He not only fleshed out a number of step-by-step methods, techniques, and strategies, he also taught how to listen to both the land and the client, connecting the two in a cohesive project that resonated with the land steward and was beneficial to the overall landscape. He demonstrated how to increase landscape function by integrating soil, water, and vegetation with slope, sun, wildlife, and human connection. His decades of dedication, integrity, community connection, listening to the land, and openness to learning new things are all present in this extraordinary book.

If you think about it, there is a huge amount of land that is stewarded by both homeowners and renters as part of home residences. Imagine if everyone considered themselves a steward of an ecosystem in their yard rather than seeing it as just a landscape or garden. If whole

communities adopted the ethics and principles of regenerative landscaping, we could do so much to reverse climate change by sequestering atmospheric carbon back into the earth as healthy soil and plants. It would eliminate the need for chemical fertilizers and biocides and would increase ecological health in urban and suburban communities.

The book you are holding in your hands is a complete work on permaculture and regenerative landscaping, but it also includes many other topics one might not consider related to ecological or regenerative landscaping. This is because Erik is a whole-systems thinker. A whole systems thinker can't separate nontoxic natural building from watershed health, land use, habitat development, and economy. They are all interconnected and related to each other. Reading this guide will bring to light in detail why and how these are related. An example of this interconnection is the relationship between water runoff and salmon spawning. If everyone could manage the water runoff on the land they are stewarding in a way that eliminates erosion, salmon would be able to complete their spawning process and the eggs would be allowed to hatch, thus bringing salmon back to abundant populations after being designated as nearly endangered.

So this is more than just a manual on regenerative landscaping. It offers a unique and comprehensive understanding of the design intelligence that the natural world has to offer us, with the capacity to change the world of landscaping, gardening, and earth stewardship. It helps us to become better human beings and aids us in remembering our original operating instructions for stewarding and tending the land in a good way, one yard at a time.

As we embark on an era of species extinction, climate change (global weirding!), and ecological collapse, this book is more important than ever. Grim statistics are coming more and more into our view. I have hope that we can still shift the pattern of destructive, extractive practices to a pattern and relationship of renewal and ecological health, providing abundance for humans as well as wildlife.

If you want to make an impact in the world, it isn't up to just you or even a few of us. It really depends on millions of people making positive change. *The Regenerative Landscaper* is a comprehensive how-to guide for ecological landscaping and a basis for ecological literacy, infused with Erik's profound knowledge and experience of permaculture and landscape design.

Upon gaining the knowledge offered here, you—the reader—will learn how to steward land and create ecologically rich, abundant gardens and landscapes. The more people who have access to the information offered here, the more ecosystems on this earth can be restored. When people understand that they are a keystone species, they can learn to behave like a probiotic on the earth, restoring ecosystem health one garden at a time. The world will change when people remember the sublime design intelligence of the natural world, with humanity as stewards of this beautiful garden planet.

## HOW TO USE THIS BOOK

*The Regenerative Landscaper* is organized to assist you, the reader, through your landscape projects from beginning to end. There are many reasons to create a regenerative landscape—beauty and function, resilience, sovereignty. Whatever your goal, this book guides your way.

Here I share with you the same project-sequencing approach I have used in professional landscaping for decades, bearing in mind that each designer dwells in a particular context that has its own emerging timeline.

You will be guided as you observe your project's context, conduct site analysis, create and install your design, and finally move into stewardship—or maintenance—of the land. Written like this, the process looks linear, but in truth it is dynamic and cyclical. Each project will veer onto its own path and follow its own natural trajectory, but the sequencing shared here is always indispensable.

If you are new to regenerative design, follow the progression of the book as laid out. If you are already highly experienced, you may skip around to relevant sections, step-by-step processes, and case studies as needed for your project. The index at the back of the book will help you find your desired topics.

The information in this book is comprehensive and time-tested. If you find yourself returning to *The Regenerative Landscaper* as a reference guide, then it has achieved its purpose.

# INTRODUCTION

Imagine you step out your back door and are immediately greeted by birdsong. Trees sway in the breeze as you hook your basket onto your arm and set out to harvest fresh herbs for your breakfast. You enter your garden where an abundance of food and flowers await. Butterflies and insects buzz by, drinking from the sweet nectar your garden provides. Within ten minutes, you've filled your basket with just-ripe veggies, fruits, eggs, and herbs for your day. A bundle of cut flowers rests on top—an offering to beautify your home. This is a landscape of real abundance.

I remember the moment when I realized what true abundance and wealth was—abundance for my family but also for all the life in my garden. I was grazing on blueberries, cherries, and mulberries, watching plums ripen, the symphony of birdsong deafening. It was late spring, and I noticed that the diversity of birds and wildlife visiting the homestead had more than quadrupled in the five years since we built this landscape.

Bewick's wrens had nested in a bird box we had hung from an old maple. Brown creepers (a rare sight) had found a crack in the bark of a redwood tree and built a home there. House finches nested against the house on top of a forgotten broom. Numerous other species—quail, titmouse, bushtits, towhees, foxes, opossum, pygmy owls, red-shouldered hawks, barn owls, bats—all made their home on this one-acre homestead.

My belly was full of fruit and my mind calm as I watched two western pond turtles sun themselves among a half-dozen species of emerging dragonfly in the pond. This is what abundance looks like to me. I spent six months building that pond and now it is a temple of life and a place to soothe the soul.

This same lush landscape solves multiple environmental crises. It catches and stores water, which is becoming ever more critical for combating drought and fire. The biologically rich topsoil sequesters carbon and feeds a thriving plant community that, in turn, feeds the living web of soil. The garden serves as a true safe harbor for threatened and endangered birds and insects.

If this inspires you to act—if the voice in your head is saying *Yes!*—you're in the right place. In these pages, you will find step-by-step instructions for designing and turning your yard into a **regenerative landscape**. This book not only provides a plethora of ideas but acts as a practical (day-to-day, month-by-month) manual, documenting the entire process and mind-set you need to create ecological paradise.

I know this kind of landscape is possible because I've been doing this work for more than 20 years. I've had the privilege of building hundreds of regeneration projects—with private

landowners, nonprofits, schools, and cities—mostly in the United States but also throughout the world. This work has given me hope that even during the darkest times, regenerative solutions bring about a more peaceful and abundant world. I hope this book infuses that same hope in you. You can use this book to create a healthier and more beautiful world for yourself, your family, and your community. When you become a steward of the land, your yard not only sustains but actively regenerates natural life-support systems of the environment. Once you understand the systems of your specific project, you can begin to enhance how they function. Achieve this and your landscape will respond in kind with beauty, food security, and climate stability.

We can do this one yard at a time: land at every scale—every barren, sacred piece of ground—plays a part. Your own front yard can repair the earth. As a result of your regenerative landscape, you play a part in managing a healthy water cycle, turning soil into carbon-harvesting reservoirs, and cultivating personal sustainability by growing medicinal herbs, fruits, and vegetables. Growing food and medicine can literally save you thousands of dollars a year in groceries while helping safeguard your and your family's health as you enjoy more nutrient-dense food. There has never been a better time to move in this direction.

At the root of all regenerative practices is the living wisdom of Indigenous people. Honoring the native people and practices of your area is an inextricable part of understanding the landscape. There is a common bond we all share that traces each of us back to our early ancestors. This bond represents the relationship between people and land; it is a gift but it comes with a great responsibility.

For thousands of years humans across the globe maintained a balanced partnership with their habitats. Much of that knowledge has been lost to colonization, but enough of the old ways remain to seed a new reciprocal relationship with landscapes. Humans are intelligent. But the process of colonization might cost us everything if we don't urgently change our cultural land-use practices. The ingenuity of our near ancestors and their relationship to their environment has, for better or worse, spawned human civilization as we know it. Selective plant breeding, domestication of animals, changing the physical shapes of landscapes—these abilities, now inherent in all human societies—have enabled people to transform land into food-growing systems (agriculture). The same knowledge that founded civilization has been used to disrupt and destroy living systems through industrial agriculture on a planetwide scale.

We are now at a crossroads. How we treat our landscapes and each other defines the fate of all future generations. We still have a choice. We can use this power either to destroy or to renew. Do we continue to take the destructive path, accelerating mass species extinction, poverty, and climate disasters? Or do we take the path of regeneration, where we dust off the ancestral ways and do the real work of repairing our ecosystems?

No matter our political ideology, culture, or religion, we are all united by a few basic elements, the forces that shape our planet. The forces of the sun, life-giving water, and the magic of the chlorophyll molecule—these systems undeniably connect every human and every living thing in the web of life. By picking up this book, *you are choosing renewal*. Inside, you will find comprehensive, easy-to-follow methods for transforming a patch of earth into a life-sustaining

regenerative landscape. You'll discover answers to your questions, but you'll also discover how to *ask* the right questions—how to listen to the earth in all its complexity and splendor.

The regenerative path unfolds in front of you. The tools you need are here in your hands. Join me on this journey as we repair the land together.

PART I

# The Wisdom of the Earth





# Earth's Design Intelligence

Regenerative landscaping focuses on increasing the health and productivity of ecosystems: managing landscapes, farms, and gardens to enhance the life-giving processes occurring in these ecologies. This approach builds soil carbon, increasing soil's capacity to hold water and distribute nutrients to plant life. In a regenerative landscape, we manage a healthy and functioning hydrologic cycle, catching, storing, and infiltrating storm waters, reducing floods, erosion, and drought.

We are living through the sixth mass extinction,<sup>1</sup> an event marked by the disappearance of plant and animal species every day. Truly ecological landscapes focus on preserving biodiversity and building habitat for wildlife, turning landscapes into refuges for all manner of animal and plant life to thrive. Butterflies, bees, hummingbirds, snakes, lizards, frogs, mammals—think of all the diversity on this earth to celebrate and steward. But first, you need to recognize the habitat that already exists on a site and be careful not to destroy it in your landscaping work.

Many well-intentioned landscapers damage intact ecologies, blinded by their enthusiasm for making beautiful gardens. That is not the way of regeneration. Our choice to leave landscape systems alone is as important as our desire to change them. Learn the way of the site first so that your design will truly fit the context of the land. I will teach you how.

My goal is to help you design, develop, and manage regenerative landscapes. The landscape around your house, the local park, an agricultural operation—all scales are relevant—every single space can be an ecological model in your community.

This book provides the day-to-day practical methods of building regenerative landscapes, from understanding project context and reading natural patterns to drafting and presenting designs, from the installation of landscape systems to monitoring, maintenance, and long-term stewardship. Each part features case studies of real projects that showcase brilliant landscapes, regenerative designers, and farmers.

My dream is that you honor this book with dirty finger smudges, use leaves as bookmarks, and refer to it time and again for your design and installation projects. It's here for you when you forget what the next step is, when you need an extra bit of inspiration, and when you want to remember the creative ways people have already solved the problem you're up against.

## THE INTELLIGENCE OF EARTH

For billions of years the earth developed and refined innovative systems for supporting life—the water cycle, the chlorophyll molecule, the shield against the sun (atmosphere), a dynamic

surface composed of forests, wetlands, grasslands, mountains, deserts, oceans, and you and me. All these elements are woven into an interdependent whole—earth.

Understanding how ecosystems function to support communities of living organisms is the *first* layer of knowledge required to design regenerative landscapes. This host of relationships and cyclical processes that make up the design wisdom of the earth is our primary inspiration for regenerative design.

Ecosystems are composed of specific patterns and processes that work together to grow life. As regenerative landscapers, our task is to assist, enhance, and repair these life-support systems. When we do it correctly, we (by default) enrich humanity with resources—nutrient-dense food, clean water, herbal medicines, and immense beauty.

### *Interdependence*

When living and nonliving things, including humans, are working together through mutually beneficial relationships, they are modeling interdependence. A tree provides a home for a squirrel; the squirrel plants the tree's seeds. A bison grazes on grass, and the grass utilizes the bison's manure to grow big and strong. There are infinite examples of these cooperative relationships, which leads us to the awareness that everything is dependent on everything else. When we break these connections, ecologies degenerate and collapse becomes imminent.

Ecological crisis has been culminating for hundreds of years through deforestation, desertification, biodiversity loss, dying oceans, and catastrophic climate events. Many life-support systems of the earth have been broken, and we are the ones who can mend them. Before we engage in this restoration, we need ecological literacy—the understanding of how rain is formed, how forests evolve, how the carbon cycle works, and much more.

## **THE HYDROLOGIC CYCLE: THE BLUE PLANET**

Our wonderful blue Earth is the only known planet with water molecules in all of their three forms: solid (ice, snow), liquid (water), and gas (water vapor). The movement and distribution of these waters is called the hydrologic cycle. Three percent of the planet's water is freshwater and two-thirds of that is locked up in ice caps, glaciers, and inland seas. That leaves 1 percent of all the water on earth to provide for the terrestrial biosphere (plants, animals, humans).<sup>2</sup> Powered by our closest star, the sun, the water cycle constantly recycles freshwater through the processes of evaporation, condensation, and precipitation (rain, snow), with evaporation and its sibling, transpiration, being the main drivers of precipitation.

**Evaporation:** Movement from the sun and wind creates heat that evaporates water, turning it from liquid to gas. The water vapor rises into the atmosphere until it hits cold air, causing water molecules to condense into clouds. Eventually this water will return to the earth in the form of rain or snow. Evaporation constitutes nearly 90 percent of all atmospheric moisture.<sup>3</sup>

**Transpiration:** Trees and plants uptake water from their roots and transpire water vapor through their leaves, which enters the atmosphere. Much of the rain that falls on inland areas

comes from rain clouds formed through forest transpiration.<sup>4</sup> This is one reason why humanity needs to be planting more trees a year than we remove. When we remove trees, we remove the rain. When we plant trees, we plant the rain.

### ***Natural Water Storage***

Once rain or snow falls to the ground, what happens next is of utmost importance. Every ecosystem has its own form of water storage, and caretaking these storage systems is part of our work as regenerative designers. Groundwater is one of the most significant water-storage systems, providing for most of the biological needs of life on land. Humans can make the largest restorative impact on groundwater by aiding stormwater infiltration and reducing our dependence on groundwater for agricultural and domestic uses.

### ***Snowpack***

In mountain regions, snowpack provides a remarkable form of freshwater storage, capturing winter snowstorms and then slowly feeding rivers and lakes through snow melt the rest of the year.

### ***Vegetative/Animal Storage***

In desert ecosystems, water is mainly stored in cacti and succulents, ingenious storage systems in regions with extreme arid conditions. All plants store some moisture. Animals (including humans) do as well. We are all just sacks of water, imbibing and excreting moisture all day, every day of our lives.

### ***Rivers and Lakes***

Bodies of freshwater, like lakes and rivers, make up nearly half of available freshwater sources. Rivers also distribute water and nutrients throughout the environment. The volume held in these bodies of water is dependent on factors such as the state of the groundwater table, snowpack, and regional precipitation events.

### ***Condensation***

When water vapor transforms from gas to liquid, it's called condensation. This happens when warmer air cools to its *dew point*—the temperature needed for airborne moisture to condense.

In addition to dew point, water molecules need surfaces to form into liquid. Condensation in the atmosphere is dependent upon *aerosols*—tiny particles that provide a surface for liquid water and, when combined, form clouds, storms, rain, and snow.

The same can be said for morning dew on grass or moisture on the outside of a glass filled with cold water. In these instances, the air has cooled to the dew point, condensing upon the grass and glass surfaces. (Have you ever drunk morning dew from the leaf of a plant? It's a highly recommended experience—just make sure the plant isn't poisonous!)

Aerosols in the atmosphere come in many forms: minerals, dust, pollen, and other fine particles that form cloud condensation nuclei (CCN).<sup>5</sup> These particles rise from the earth and catch air currents that draw them high into the atmosphere where they help form clouds.

A seldom studied yet vital component of our water cycle is dependent upon a special type of atmospheric aerosol: the biological kind. These primary biological aerosol particles (PBAP) seed the sky, providing cloud condensation nuclei to make rain.

### ***Bacterial Rainmakers***

The most effective bacteria for providing cloud condensation is called *Pseudomonas syringae*. This innovative organism is not only responsible for helping seed rain in the atmosphere, but it also causes ice nucleation. Ice nucleation happens when water vapor condenses directly into ice in cold temperatures. In this way, *P. syringae* help make snow, sleet, and ice. This bacteria, and others of its kind, are commonly parasitic to plants and trees, which is where they develop and release their rainmaking spores.<sup>6</sup>

### ***Fungal Rainmakers***

Fungal spores also provide biological aerosols for making rain. A large group of fungi called *Basidiospores* eject 50 million tons of airborne spores every year. These tiny particles float around the atmosphere, seeding clouds and falling back to earth to spread their kind.

Many of these mushrooms use a “surface tension catapult” process that turns the spore into a ballistospore with 25,000 G of force (10,000 times more than a rocket ship) to explode into the air. When a droplet of water forms and falls from the spore’s surface, it releases the surface tension catapult, firing the spores into the air.<sup>7</sup>

With fungi and bacteria acting as biological aerosols, it’s easy to conclude that forests and grassland ecosystems are vital components for not only the transpiration of moisture, but the seeding of clouds.

### ***Water Runoff***

Clean, accessible freshwater is being lost at an alarming rate with dangerous consequences for environments, watersheds, and human communities. Runoff is one of the biggest contributors to polluting water, eroding soils, and depleting freshwater sources. Agricultural soils, roads, pavement, houses—all these impervious systems have broken the natural capture and filtration of rainwater. This, along with overconsumption and chemical intensive agriculture, contribute the greatest impacts to the global freshwater supply.

Regenerative design offers many solutions for managing water runoff, with stewardship of freshwater providing the basis for all foundational design features. Landscape designers (hey, that’s you!) have many opportunities to manage water cycles that clean, store, and increase availability of freshwater. That’s good news because the process of aridification has increased dramatically around the planet with cracked, dry soils and shimmering waves of heat sprawling in its wake.

An arid landscape is an environment where evaporation exceeds precipitation. (Humid climates are the opposite! Precipitation exceeds evaporation.) Aridification—when the land becomes drier and drier over a long period of time—threatens an ecosystem’s ability to hold water and therefore support biological communities. Often, this is due to a reduction of precipitation (rain, fog, sleet, snow), groundwater loss, increased evaporation, and lack of ground cover. As vegetation dries out, the aridification process intensifies and the surface of the soil heats up, which can lead to desertification.<sup>8</sup> That’s why understanding the water cycle is foundational to restoring ecosystems.

## THE CARBON CYCLE: LIFE’S ORIGIN

Like the water cycle, the carbon cycle provides the basis for life on earth. Eighteen percent of the human body is made of carbon. The stem and leaf mass of herbaceous plants is composed of nearly 45 percent carbon while nearly 50 percent of woody plants (trees) are made of carbon. We are all connected: people and trees and animals.

There are five main carbon sinks (systems that absorb carbon) on earth: the ocean, the atmosphere, stone/sediment (including fossil fuels), the interior mantle of the earth, and the terrestrial biosphere (plants, trees, soil). We as regenerative designers can directly influence only the terrestrial biosphere, thereby affecting the atmospheric carbon sink at the same time.<sup>9</sup>

The excessive amounts of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases entering the atmosphere have resulted in the trapping of heat, warming the earth and generating extreme climate events worldwide. Carbon dioxide operates under natural laws that we humans manipulate through activities like plowing the soil and burning fossil fuels, which can lead to disaster. However, we can do things differently. Planting trees, along with ecological grassland and ocean management, aids in the removal of excess carbon from the atmosphere through the power of photosynthesis. We either build landscapes and farms that release carbon dioxide (tilling, paving, draining), adding to catastrophe, *or* we build landscapes that sequester (draw down) CO<sub>2</sub> into trees, soils, and prairies.

### *Liquid Carbon Pathway*

In the liquid carbon pathway, plants take in carbon dioxide through the process of photosynthesis, transform this CO<sub>2</sub> into a source of food, then offer it to a wide range of organisms. Up to 30 percent of the carbon a plant absorbs from the air is released as plant exudates from its roots into the soil. Fungi and bacteria feed on this carbon, making it available to other organisms, while feeding the plant minerals and nutrients in exchange for this carbon gift.<sup>10</sup> This model is a stunning display of reciprocity between a diversity of species—a web of relationships that keeps the living world alive.

By aiding terrestrial carbon sinks (the biosphere), we beneficially affect both carbon and water cycles. When we sequester carbon in plants and soil, we not only reduce the atmospheric load of carbon, but with every 1 percent increase of carbon per acre of soil, we increase its

water-holding capacity by approximately 25,000 gallons! The soil is a literal reservoir for carbon and water, and a regenerative landscape will have ample amounts of both.

### ***Grassland and Forest Carbon***

Part of stewarding the carbon cycle includes protecting grasslands and forests from destruction. There are 10 to 12 billion acres of grazing grasslands on earth, constituting a massive carbon sink. Many perennial grasses develop 10 times the underground root growth compared to their above-ground leaf growth, providing a large liquid carbon pathway to feed carbon-storing soil life.<sup>11</sup>

In Northern California where I live (on unceded Pomo and Miwok land), we are home to the tallest trees in the world, the coastal redwood (*Sequoia sempervirens*). These ancient groves, with some trees over 3,000 years old, are the greatest carbon-storing forests in the world. It takes approximately the same amount of time for a fallen redwood tree to decompose as it did to grow. That means that a 1,000-year-old tree would release stored carbon over 1,000 years.

All old-growth forests represent major carbon storage systems. They can hold 30 to 70 percent more carbon than second- or third-generation forests. These ecosystems desperately need protection to keep the planet's climate in balance. So far, half of earth's forests have been lost and only a fifth of what remains is in pristine condition. In some areas we can reverse this trend through afforestation (planting trees), but protecting what's left is also necessary.

## **PHOTOSYNTHESIS: THE MIRACLE OF LIFE**

The earth is innately regenerative, but the usable energy for growing living systems is reliant upon a green, vegetated landscape. Photosynthesis and its ability to turn sunlight into usable energy is one of the most fundamental gifts to life on the planet. This process is made possible by the tiny chlorophyll molecule. Here is how it all began.

Millions of years ago, microscopic ocean bacteria learned to convert sunlight into proteins and carbohydrates. These cyanobacteria were the first organisms to develop photosynthesis. Over time, these bacteria combined with other more complex organisms, leading to the birth of the plant kingdom.<sup>12</sup>

Chlorophyll is a green pigment molecule that makes its own food by using the energy of the sun and transforming it into sugars and proteins. Inside the cells of plants are tiny structures called chloroplasts. These chloroplasts are the homes where chlorophyll molecules are located inside plants. In the process of converting sunlight, carbon dioxide is absorbed from the air and oxygen is then released. This process comes with a small cost. For photosynthesis to take place, the chlorophyll molecule must consume minerals and nutrients to fuel the process. Every food web on earth, from marine environments to terrestrial landscapes, begins with photosynthesis, making the chlorophyll molecule the very basis for life on earth.

Planting gardens, reforesting degraded landscapes, growing food—at the center of each of these acts is the carbon-harvesting, sunlight-absorbing, oxygen-exhaling, matter-producing miracle of photosynthesis. Plants are the greatest allies in the work of regenerating the earth.

### ***Forest Ecology***

The world's forests are massive carbon sinks, making up nearly 45 percent of land-based carbon. Some forests convert up to 5,000 pounds of carbon dioxide per year per acre! Forests are living systems that provide key ecological functions to build soil, home animals, and manage micro and macro climate patterns.<sup>13</sup>

Currently forest covers approximately 30 percent of earth's terrestrial surface, making up more than 3 trillion trees. It sounds like a lot, but it is half as many trees as the earth sustained at the dawn of human civilization. Still, we are losing 15 billion trees a year to toilet paper production, timber, farmland expansion, and other human industry.

Forests modify weather in a variety of ways including surface albedo (reflection/absorption of light), transpiration (from vegetation), and wind absorption (aerodynamic roughness).

Tropical forests, for example, transpire enough moisture to generate large rain systems. This has several effects. The process of transpiration produces “evaporative cooling,” which cools the forest floor during transpiration. At the same time, as new clouds are formed, their high albedo reflects sunlight away from the region and cools the land even further. They're like huge, natural air-conditioners.

Throughout the globe, clouds generated from the transpiration of forests are often the *only* precipitation source for inland environments, exemplifying how important a role forests play in managing a stable water cycle. After you drink a big glass of water, you might want to go hug a tree and say thanks.

Unlike surfaces like snow and ice, which reflect significant solar energy back into the atmosphere, forests absorb heat from the sun, warming the air in cold environments due to their low albedo but cooling the air in warm environments by keeping solid radiation from warming the soil surface (shade).

The water that a single tree transpires daily has a cooling effect equivalent to two domestic air conditioners.<sup>14</sup> The shade produced by forest canopy can cool the surface of the earth up to 20°F–45°F! This drastically reduces the heat island effect in our urban centers and can determine whether land is farmable in our agricultural landscapes.

The texture of the forest provides yet another climate moderation service. As wind moves across the surface of the earth, forests catch the moving air, slowing it down and absorbing the energy. The air releases energy, causing the forest to transpire faster, leading to the development of more clouds.

Some forests harvest fog, a unique way to cycle moisture. These systems, like the redwoods of Northern California, broom (capture) the fog, literally taking moisture in through canopy leaves to feed the trees. Fog is also caught along the needled leaves and drips down along the branches, grabbing nutrients on its way and finally reaching and nourishing the forest floor.

Most forests are fungal-dominated fire ecologies, producing a large amount of the earth's oxygen. One tree produces 260 pounds of oxygen per year; all together, all the trees on the planet exhale approximately 30 percent of earth's oxygen every day.<sup>15</sup>

When rain, snow, or hail fall, a forest creates its own nutrient-rich fertilizer. This is called “throughfall”—when precipitation moves through leaves, branches, and trunks of trees taking with it bird manure, dust, bacteria, and fungi that wash down to feed the forest floor.

Forests are a wonder of this green earth. That is why, as regenerative designers, we imitate the patterns and relationships that comprise forest ecologies in our design plans. Even the way we grow our food and fiber comes from emulated forest systems called agroforestry.

Replicating forests through agroforestry brings many benefits to the landscape: the production of leaf mulch and woody debris builds fertility, along with an increase in water-holding capacity, biological diversity, and carbon sequestration. Forest ecosystems are perennial and multigenerational. A landscape built like a forest becomes a long-term, low-maintenance, high-productivity system that creates multigenerational resilience for all of life.

### ***Wetland Ecology***

Wetlands are the most biologically productive ecosystems found on the planet. They are formed through webs of interdependent relationships between terrestrial and aquatic ecosystems (land and water). Wetland trees build fertile soil and protect waterways by holding the land together with their root masses.

Like forests, wetlands are an integral part of the carbon cycle. Covering 6 percent of Earth's land surface, wetlands (including marshes, bogs, swamps, river deltas, mangroves, tundra, lagoons, and river flood plains) store 10 to 20 percent of terrestrial carbon.<sup>16</sup> Wetlands also protect the land from storm surges. The bottomland riparian wetland forests along the Mississippi River once stored more than 60 days' worth of flood water. Now, due to these ecosystems being filled and drained, only 12 days of flood water can be stored.<sup>17</sup>

These are carbon-farming systems like no other on earth; the plant ecologies that thrive in many wetland systems are carbon-sequestering superstars. Wetlands are threatened with development, disappearing three times faster than forests. If all the wetlands on earth were removed, it would release an additional 771 million tons of greenhouse gas (representing one-fifth of all the carbon on earth) into the atmosphere.<sup>18</sup>

When land and water join, life blossoms; complex and interconnected food systems emerge, creating a thriving environment for many aquatic and terrestrial lifeforms. Self-replicating cycles are set in motion. Seed, fruit, and nuts fall into the water, feeding fish and aquatic life. Mammals, sea turtles, and thousands of other species of invertebrates, insects, amphibians, and reptiles all interact in a web of relationships. It's a dynamic cycle of growth, life, and death. These are systems that inspire some of the most effective water design strategies of a regenerative landscaper, utilizing the patterns of wetland ecosystems and many of their variations.

Ponds, blackwater systems, constructed wetlands, water harvesting gardens—any system where water is collected, infiltrated, and filtered can function as a wetland.



### *Grasslands Ecology*

Lawns, the most widely spread human-built landscape in the world, attempt and fail to mimic grassland ecology. Lawns are grass-based systems devoid of the life grassland ecosystems support; they are monocultures designed only for the human-centered functions of recreation and status.

Grassland ecologies, however, are havens of life. These wild places are filled with perennial grass species—many with deep root systems—feeding the soil with nutrients, holding it against erosion, and drawing carbon deep into subterranean soils. Some grass roots penetrate dozens of feet into the ground, pulling organic matter and carbon into places where it can be stored for many years. A healthy grassland is composed of a high diversity of closely spaced grasses and herbaceous plants. Hundreds of species, from bison to butterfly, depend on these prairie biomes.

In landscape design, we can create and manage ecological grassland ecosystems by incorporating regionally native grasses, forbs, and shrubs into the design to simulate the best functions of native prairies, generating many yields along the way. We can even grow edible greens, medicinal roots, berries, and other food and medicine from within managed grassland ecologies.

## **KEYSTONE SPECIES**

Every ecosystem on earth is composed of a unique set of relationships: patterns formed by species, climate, and soils, by water, rock, and sea. But some universal patterns are present throughout the planet's biosphere. One core pattern we observe is the presence of *keystone species*. These are species of plants, animals, or microorganisms that provide benefits on which the ecology is completely dependent. Remove the keystone species and the system begins to collapse. Every place we live—every home, park, and landscape project—is influenced by its relationship to the keystone species of that region.

### *Rivers of Salmon*

I live in Northern California where creeks and rivers once ran thick with salmon. The Indigenous people of these lands have always revered salmon as sacred creatures of these waterways. As a keystone species, whole watersheds depend on salmon for bioregional survival and longevity. Some salmon species like the coho (*Oncorhynchus kisutch*) are endangered due to overfishing, watershed pollution, gravel mining, soil erosion, and other industrial practices that have destroyed salmon spawning grounds.

Born in the headwaters, young salmon are reared in the creeks and rivers of their birth for one to two years before venturing into the wilds of the ocean. There they travel far out to sea, eating fish and plankton. When mature salmon are ready to spawn (2–8 years old), they return to their natal rivers and creeks.<sup>19</sup>

Their journey in the ocean, where they grow large from marine food they eat, can span *thousands* of miles, yet they know the precise river mouth where they will return, back to the watershed of their birth. Once returned to home waters, more miracles occur. They swim against fast

currents and jump waterfalls until they reach the headwaters. When they reach their spawning grounds, they use the last of their energy to seed the next generation of salmon. Then, they sacrifice their bodies and . . . die.

Upon death, the rich, fatty bodies of salmon return minerals and nutrients to the upper reaches of the watershed. Bears, eagles, and other scavengers take advantage of the martyred salmon and consume and distribute those nutrients across the environment. Salmon become not only food for wild animals but minerals and nutrients that trees, plants, and soil life also depend on. As we have seen throughout the Pacific coast and elsewhere in the world, when salmon disappear, the landscapes of their origin become susceptible to disease and famine.

### ***The Power of Bees***

Global food production as we know it is dependent on the small, humble bees (*Apis*) of our world. The common honeybee, along with native bees of each bioregion, are so widespread and integral to the human food system that 71 percent of food-producing plants we grow are pollinated by them. They are a keystone species for the survival of humanity. Not only do bees ensure fruits and vegetables are pollinated, but they are also responsible for mixing the pollen of insect-pollinated trees and flowering plants, helping the botanical world adapt to changing conditions, fend off disease, and reproduce each year. If bees continue to disappear (as they have recently due to industrial agriculture practices), thousands of species of plants and animals will disappear with them.<sup>20</sup>

### ***Red Mangrove Coastlines***

Keystone species come in many forms: animals, yes, but also trees, plants, even bacteria provide ecological services worthy of any keystone species. The red mangrove (*Rhizophora mangle*), a riparian tree that grows along subtropical coastal waters, is a keystone species that builds complex ecologies in its wake. Thousands of species of sea life—sea turtles, fish, manatees, dolphins, sharks, and many more—all thrive amongst the tangled root systems mangroves cast into the water's edge. Without these mangrove ecosystems, much of the life that depends on them would have to travel long distances to find safe havens and many would die along the way.

### ***Bioregional Keystone Species***

At every landscape scale—city urban backyard, thousand-acre snowy ranch, suburban homestead—keystone species are present and must be taken into consideration when designing new landscapes.

Identify the keystone species in your region. What is their habitat and how can you enrich these systems? What can you do to manage the land and implement support mechanisms to aid these key organisms? Sometimes their influences are indirect. For instance, salmon don't spawn on my homestead, but the activities of my landscape directly impact watershed health. If I allow surface water to shed from the land, taking sediment with it, I'll be directly adding to the plight of the salmon as downstream creeks and rivers get polluted by my erosive landscape.

Everything is connected in the webs of life. How does your landscape affect keystone species in your environment?

## REGENERATIVE DISTURBANCES

Every ecosystem is held together by a network of patterns and processes that manage the organization and evolution of each environment. Many of these processes are initiated by some form of disturbance: a wildfire, a herd migration, a flood. These events may seem devastating, but in a balanced ecology they provide beneficial services. By understanding the roles disturbances play in the landscape, we can mimic and utilize those forces to regenerate ecosystems.

Some disturbances create conditions for new beneficial patterns to evolve in the landscape. We can call these “regenerative disturbances.” Systems are always evolving and when one becomes stagnant, it can become diseased and dysfunctional. A disturbance breaks the stagnation and kickstarts new cycles.

### *Mimic Herd Migration*

Many environments across the globe are managed (now or in the past) by the migration of ruminants. Ruminants are hooved animals that migrate through the seasons in large herds, eating grasses and broad-leafed plants along the way. The time a herd spends in one area and the path of its migration coincide with the movement of predators and access to food. This predator/prey relationship occurs throughout many environments and plays a significant role in sustained regenerative management of prairies and savannas. The roving herds reduce fuels for wildfires, keep opportunistic plants in check, and stomp organic matter into the soil.

Due to overhunting, industrialization, and private property ownership, along with other environmental and human causes, migrating herds across the world have mainly disappeared. To bring back these important migration patterns (especially where native animals disappeared) ranchers use domesticated animals (cows, sheep, goats) to mimic natural herd behavior. Many reading this book are not likely to manage a large herd of animals, but it is helpful to understand what benefits animals provide in managing the environment. In this way we can replicate their behavior in the landscape.

When animals move through a system regeneratively, they provide a series of benefits. They graze/browse vegetation, shearing off the tops and sometimes causing root die-off, which feeds the soil organic matter and (if not overgrazed) stimulates new growth in plants. They leave behind manure (fertilization), and in short durations stomp organic matter into the soil, creating ground contact with leaves and stems, allowing microorganisms to transform that organic matter into healthy topsoil. As animals graze on vegetation, they create conditions for a high diversity of plants to thrive. This ensures that no one species dominates by shading out the others.

We can simulate the benefits of animal disturbance in our own gardens and landscapes. On a small scale, we can do this by keeping chickens, ducks, goats, sheep, or maybe even a cow. But

having animals in the system is not always appropriate or practical depending on the context. There are ways to mimic these kinds of disturbance patterns by being your own animal through mowing, scything, and pruning. (See chapter 50 for more about including animals in your regenerative landscape.)

### ***Become Fire***

Fire is a major disturbance, a natural pattern that has coevolved throughout many ecosystems called fire ecologies. In spite of human efforts to suppress new fires, these lands will inevitably burn. In fact, suppressing fire leads to an abundance of fuel that builds up over time, eventually leading to megafires.

Indigenous people have been introducing fire to the land for millennia, creating “good” fire through cultural burning as a vital tool for managing fire ecologies. Indigenous knowledge helps us decode fires past, but their wisdom is also paramount to how we live and manage our communities in fire zones today. We start with understanding the lessons fire teaches us and the various impacts flame, heat, and ash have on the land, both the regenerative and the catastrophic.

Fire is nature’s way of removing disease, clearing forest understory, bringing in light to the forest floor, alkalizing soil, and transforming minerals into bioavailable forms for plants and animals.

We use good fire to manage our environments, but we also simulate fire’s effect on the land in other ways. Sustainable forestry, weeding, chopping, clearing, spreading ash—all these activities have similar effects to a low intensity fire. (See chapter 53 for more about fire in the regenerative landscape.)

# The Regenerative Mindset

Regenerative design and stewardship are a set of practices, a mindset, that increase the health and productivity of ecosystems, resulting in the development of carbon- and water-holding rich soils, clean and abundant watersheds, and increased habitat for wildlife.

Everyone can approach landscaping through the lens of regenerative thinking. These tools and principles are not relegated to use by professionals and people with access to more resources.

Approaching a landscape project with a regenerative mindset requires a focus on designing relationships over elements. For example, if you are building a pond for water storage, you want to consider the many relationships and benefits a pond provides to your landscape. It is not only a water-storage system but also a microclimate moderator, a habitat attractor, a biomass generator, and so on. If you design relationally, you will place the pond and other elements strategically to synergize and capitalize on the resources provided by the pond. The same can be said about every layer and element in the design process. To design as nature, to generate landscapes that provide high yields, and to create energy-efficient regenerative systems, relationships must be the focus of the design process.

Even the most degraded landscapes—man-made deserts, clear-cut forests, asphalt parking lots—can be repaired. The application of regenerative design processes and principles can bring these systems back into ecological health. A patient mindset and trust in natural processes are key ingredients in ushering this level of ecological regeneration.

There is so much potential to repair the living world. We can all start right outside our backdoors, in our local parks or community gardens. Once you unlock the regenerative toolbox, you will see potential on every site. Advanced practitioners will notice that some landscapes are better left alone. Intervention is not always necessary, and sometimes our goals and well-intentioned activities can create more harm. For example, I've seen many practitioners cut down trees to build a "habitat" garden, essentially killing the habitat that was there. Learn to listen and observe landscape patterns, determining when it is more appropriate to do nothing.

## **EMBRACE EARTH WISDOM**

At the heart of regenerative design is the practice of emulating and enhancing the design intelligence and patterns of ecosystems. As we have seen, earth has solutions to all the ecological crises we face today. We can design and build with the same wisdom, using the same focus on

the patterns of relationships. When we partner with the life-sustaining processes of ecosystems, that's when we remember—we *are* earth's inherent wisdom, if we choose to be.

When we develop symbiotic relationships between humans and the ecosystems we inhabit, we reduce our use of energy, we stop creating waste, and we rebuild surplus resources of food, water, and habitat that once covered every landscape. We steward landscapes that enhance rather than destroy ecosystems. The more symbiotic relationships we develop with our environments, the faster we create resource-rich gardens and farms, landscapes, and cities, and develop resilience to catastrophe (wildfire, drought, flood, famine).

## **LANDSCAPES ARE ECOSYSTEMS**

To design a landscape regeneratively is to design a fully functioning ecosystem where all elements (trees, water systems, animals, buildings, and so on) are woven together in interdependent relationships. This is the foundational approach to regenerative design: the understanding that no matter how much you impose your ideas onto a landscape, the inherent natural patterns will always intervene. That is why we compose with ecosystem forces—we utilize their intelligence and harmonize our designs to integrate fully with local environmental patterns. Even an asphalt parking lot is an ecosystem—though mostly a dead one—yet the forces of nature still apply, and eventually that asphalt will turn to soil, a process regenerative landscapers can speed up.

## **ANIMISM AND SCIENCE**

Our cultural mindset has the greatest impact on our land-use patterns and, in the modern world, science sets the rules. Science asks the questions of what is and is not possible and pushes the boundaries of what we believe to be true or false. In the world of regenerative landscaping, science is a pillar, a backbone of understanding the environment and applying proven techniques to achieve regenerative goals. As you have already seen in this book, science helps us understand how water moves, how forests function, and how life thrives. Scientific breakthroughs have cured disease, given us warm, safe homes, and provided all the tools of convenience and enjoyment of the modern world.

But science has its own negative set of consequences. The more reductionist a scientific approach becomes, the easier it is to separate elements from other parts of the ecosystem. To break things down into their smallest components can break the webs and relationships that exist at the ecological level. This kind of science has doomed much of the living world with the production of harmful chemicals, fossil fuel technologies, and a take-first mindset.

A mere few thousand years in the past, all human inhabitants of earth—our ancestors—maintained animistic belief systems that not just aided survival in their raw environments but also helped these cultures live in ecological harmony with their habitats. These belief systems harnessed taboos, seasonal activities, and mythological stories that helped maintain a balance between civilization and ecology. Guiding practices developed from stories and beliefs that enhanced biological interactions in the environment.

Animism is the belief that nearly everything is alive: stones, waterfalls, tools, homes. An animistic worldview also considers the spirits of elements like trees and animals as intellectual entities, as nonhuman “persons.” Often, trees or animals are considered relatives or even familial ancestors. When you believe that everything is alive, that plants and animals are relatives, when spiritual value is given to the land, destroying those entities becomes unethical and dangerous. These taboos translate into cultural activities that protect and celebrate landscape through seasonal observance, ritual, and ecological stewardship. Many Indigenous communities still practice these animistic ways to this very day.

As regenerative designers, we must bridge Indigenous knowledge with the application of earth sciences. I firmly believe that both Indigenous spiritual wisdom and cutting-edge ecological science must coexist—mutually beneficial to each other—to protect and regenerate what’s left of the living biosphere in earth’s current phase.

Yes, the earth will survive long after humans. Yes, the evolution of biology will spin forward, and new species and environments will emerge from the old. But I haven’t given up on earth’s current design plan. There are still ecosystems once broken that can be repaired. And still species we can keep from going extinct because of the modern human experiment.

Science can solve many problems with its focus on the intellectual process, asking questions, experimenting, and finding solutions to problems. But science doesn’t work in the social ecosystem of the human heart. And the human heart is the greatest asset we possess for protecting the living world.

Indigenous spiritual wisdom and place-based understanding that has been cultivated over many, many generations provide a worldview that connects, acknowledging that humans are within the webs of life, not separate. Everything we do matters to everything else, invoking an understanding of the responsibility humans have for stewarding, rather than destroying, the health of other life forms.

The ethical standards of science are generally subjugated by the goals of funders, meaning it is virtually impossible for science to retain any sort of ethical code because the most powerful people on the planet control the most powerful scientific research and development of technology.

The spiritual ethos of animism, however, provides a blueprint for how cultures can form with standards that protect life. Let me be clear: I’m not asking you to adopt a new spiritual worldview. Alongside your existing belief system, I ask you to consider what kinds of values we need to care for the earth. The future of our world will be what we make of it. Will it reflect the love, reverence, and collective responsibility humans are capable of? Or will we continue to treat all life as a science experiment, a commodity to be exploited?

## **REGENERATIVE LANDSCAPING PRINCIPLES**

Throughout the chapters of this book, I will provide examples of how to tangibly use the following principles as they pertain to design, water systems, soil health, planting strategies, and the built environment. These design principles are born from traditional ecological knowledge and the design practice known as permaculture design.

### *Reciprocity*

All life forms in a cycle, a never-ending process of transformation, birth, life, death, and rebirth. When the cycles that make life break, systems will perish. In the landscape, we break some cycles, and we nurture others. Knowing which to break and which to nurture is a high level of regenerative design. Based on reciprocity, we always do the following.

#### *Give More than You Take*

Those seeking true regenerative design will take this principle to heart. It is the key mindset required for living in reciprocity with the land. You may find that applying reciprocity in modern-day landscaping is difficult and can seem insurmountable at times. You might be asking yourself, “Give more than I take? What constitutes the taking?”

When analyzing reciprocal relationships in the landscape, it is important to understand the concept of embodied energy. Every material you bring to your site, including compost, irrigation pipe, and heavy equipment, has an embodied energy cost. These tools and products, often required in landscape construction, represent part of the taking—mining, fossil fuel use, fabrication. These are extractive processes that harm the biosphere.

In this day and age, it is all too easy to take and consume. As regenerative designers, we must learn to give back. In our gardens and backyards, we have that chance. We get to give back by growing soil, planting forests, and cleaning water. We give back by making sure every landscape we touch is left better than we found it. In pristine landscapes, instead of changing them, we focus on protecting these sacred places and reducing harm.

Giving more than you take directs every decision you make. I’ve seen it many times: well-intentioned designers want to achieve a particular ideal (food forest or water harvesting, for example) and in doing so remove mature trees, scrape the soil off, or destroy important wildlife habitat. Sometimes these kinds of changes are necessary, always driven by context, but often enough they are unnecessary, only emerging as an idea of the designer and not based on the fundamental health of the ecosystem. And that is why reciprocity is essential to the everyday process of design and building of regenerative landscapes.

#### *Make the Least Harm*

All living organisms are sacred and thus all design, installation, and maintenance work considers the health of living beings and causes the least harm to the land while achieving the stated goals of the project.

#### *Ecological Yield*

The biggest difference between the regenerative landscape versus “green” or “sustainable” landscaping is that regeneration means leaving the ecosystem in *better* shape than you found it. Center to this approach is **obtaining ecological yields**. For small-scale farmers and edible landscapers, harvesting a yield that benefits humans is a primary goal. Food, herbal medicine, fiber, and fuel are all important yields that support people within the ecology. But if you only design



for human needs, not considering the needs of the ecosystem, then your plan is not regenerative. Ecological yields, such as increased wildlife habitat, carbon sequestration, and increase in the water-holding capacity of soil are fundamental yields benefiting the landscape.

If our goal is to contribute to the benefit and welfare of our ecological communities, then ecosystem yields must be as important as a perceived human yield. In the end, every ecological yield is a human yield, as we are but one strand of many strands within the webs of life.

### *Contextual Design*

Instead of fighting against natural forces, we embrace and integrate them into our plan. To fully understand our environments, we must **pay attention** to the patterns! We must observe, listen, and interact accordingly. As we recognize patterns across time and space, we can successfully integrate with the landscape in ecologically beneficial ways.

Take the time to be curious and ask lots of questions. Listen intently to the people and the patterns making up the landscape and let that inform your design process. Let that be the road map you use to generate a design that works on the site. This is the context you use to design the entire project.

### *Problems Are Indicators*

Problems in the landscape are signs of disconnection—of misalignment—within the ecological webs. An indicator is usually not the root of the problem itself but a symptom. As designers, we need to ask the deeper questions and follow the signs (indicators) that lead to better understanding of how landscape systems are out of balance. Investigating an ecology is an act of listening, and this process will always yield solutions—gathered wisdom that fundamentally changes your design and implementation strategies. Problems are always indicators of elements in the system that need support and reconnection to the whole.

### *Manage Cyclical Energy*

Managing the cycles of energy (sunlight, water, wind, photosynthesis, carbon, etc.) is always at hand in the ecosystems we inhabit. In our modern civilization, the consumptive mentality of taking resources from the earth has resulted in major imbalances. For example, if you cut all the trees of a forest, you also take away the rain.

Our job as regenerative designers is to create landscapes that catch and store energy in numerous ways—cycling carbon, oxygen, nitrogen, sunlight, cool air, and water. A regenerative system, like intact ecosystems, catches and stores more energy than it consumes. In doing this, these landscapes create conditions for higher complexities of life. **Capture energy**—water, sunlight, air, nutrients—and keep that energy in the system for as long as possible. The forces of nature are present on every site. The more we capture and store available energy, the less we rely on human technology like fossil fuels for landscape stewardship.

### ***Closing Loops in the Landscape***

In conventional landscapes, excessive waste is produced in the design, installation, and maintenance of these sites. In nature there is no waste. A regenerative design emulates nature's efficiency and thus, once established, will also create no waste.

One way this is achieved is by making sure our landscapes are closed-loop systems, meaning that all resources produced inside of the landscape stay in the landscape. The waste of one element is always the food of another.

### ***Relative Location***

Every element is placed in relation to other elements and functions, so the landscape gains incredible efficiency and harvests many forms of energy. This sort of design enables the system to manage itself. To design a system that self-regulates, you place components to support and feed from each other. The “waste” of one supports the needs of the other and vice versa. If you can't see how an element in your project (pathway, water feature, tree) connects to others, then it's likely not in the right location.

### ***Redundant Planning***

Every function within a landscape needs to have a backup plan. For instance, water must come from more than one source. So should food. If we base all water needs on a single source and that source dries up—the well pump breaks or the county is threatened by drought—that single water source won't sustain the life we've built around it. Each function in your design must be supported by multiple sources.

### ***Timescale Management***

In the regenerative landscape we manage timescales in multiple ways. It starts with your own vision for a project. How long will it take? When is a good time to start? How will it be maintained?

Managing the timescale also requires an understanding of the succession of the environment you're working in. Is it a grassland? A desert? A forest? What is or was this landscape like in its natural state? Was it ever an old-growth forest or an ancient oak savanna? These questions lead to important discoveries that deepen the understanding of a place. *When* are you in the evolution of the land? How does the region where you are working naturally evolve and where is the project site within that succession?

### ***Design with Successions***

In nature, successions are the foundation of evolving landscapes. If a catastrophic firestorm (like those in California in 2016 and later) rages through a valley at high intensity and burns all the forest to the ground, a new succession will take place—but it will take time to create conditions for a forest to thrive there again. Fast-growing pioneer plants will take over first, then shrubs will advance, followed by young trees. Each succession is creating the way for the next succession to evolve from the previous one. In regenerative design we speed up or slow down natural successions depending on the goals and ecological yields we are designing for.

# Land-Use Directive

Conventional landscaping has created a host of issues, including the overuse of chemicals, water-chugging lawns, widespread soil compaction, and destruction of wildlife habitat. But it doesn't have to be that way. In this book, we get to change the landscape industry together and transform it into a healing force for restoring ecosystems. As a designer, a homesteader, or a renter, apply the principles of regenerative design to your landscape, unlock abundance, and savor the joy of taking responsibility for the lands you walk upon.

Opportunities to restore the land are around you right now. When you walk around your neighborhood, city, or countryside, notice the shapes and sounds of the world. Bring your awareness to the landscapes surrounding people's homes, the landscapes meandering through public parks, and the softened edges around parking lots. Take note of how much land there truly is within your community. In the modern world, much of what you'll observe in human settlements are nonfunctional planting systems and neglected parks. People's disdain for the land can be seen everywhere.

But deep down, every one of us enjoys the beauty of vibrant, healthy landscapes. We, as regenerative designers, are tasked with inspiring a new model for landscaping by bringing beauty, function, and ecology back into our towns and neighborhoods.

## **A TOXIC LEGACY**

Use of chemicals—for fertilization, pest management, or vegetation management—runs counter to the regenerative goals of building healthy soil and protecting biodiversity. The work of restoring and stewarding landscapes can be performed without chemicals, but much of the Western world hasn't caught on to this truth yet. The modern practice of using chemicals at all phases of land work has infiltrated the minds of the Western world in profound and damaging ways.

The scale of degenerative landscapes is astronomical. In the United States alone, approximately 40 million acres are covered in lawns,<sup>1</sup> with an estimated 235,224 trillion gallons of water used every year.<sup>2</sup> Take a moment to let that settle in. Much of that water use is required to maintain lawns. Can anyone look at those numbers and not think that this is madness? We can change this! Here in this book, I will show you how.

To transform lawns into ecological landscapes is a noble act. This alone will cause a significant shift in overall land use on the planet. In the United States, the landscaping industry in the year 2020 was worth over \$105 billion. In many parts of the world an awakening has been

taking place; people are transforming their lawns into water-friendly landscapes. Thankfully, in drought-stricken areas like California and the southwest United States, a new landscaping trend has emerged, moving away from lawns to the water-conserving land practices discussed throughout this book.

Homeowners use up to ten times more chemical pesticides per year on their lawns than farmers use on crops. Nearly 80 million pounds of pesticides are used on US lawns annually. On top of this, every year 90 million pounds of chemical fertilizers are used on lawns and 26.7 million tons of air pollutants are introduced from mowing. Yale University has estimated that the United States uses more than 600 million gallons of gas to mow and trim lawns each year.<sup>3</sup>

Regenerative landscaping is an imperative land-use approach to stop practices that destroy soil, poison waters, and kill off the world's biodiversity. At the core of this shift is moving away from lawns and other resource-addicted landscape systems. Our job now, in the 21st century, is to focus all our efforts on renovating the landscape and agricultural industries by implementing an ecological value-based system.

The needs of natural systems must be at the root of landscape design. In doing this, we will instill a landscape approach that protects ecological services and generates surplus resources for all of life.

Many folks have small lawns, and these little grasslands may not seem like they have much impact. But when we add all the small lawns together, the impacts on watersheds, public health, and biodiversity are widespread and unsustainable. That said, small lawns do have a place if you use them regularly for relaxing, sports, and giving children a place to play, providing a function that fits your context. The reality is that most lawns are hardly used and represent only a great waste of resources, labor, and money for simple aesthetics.

We can do this differently! Converting lawns into regenerative landscapes is almost always relatively easy, fun, and makes for great community-building experiences or a useful way to invest resources.

### ***Regenerate the Degraded***

Cities, farmland, forests, landscapes—the reach of human development is vast, and so is the degradation of these lands. A few hundred years of turning forests into deserts, deserts into cities, and oceans into waste dumps have damaged the surface of the earth as we know it. As regenerative designers, our job is to put the pieces of unraveled landscapes back together, the hills and valleys, the forests and meadows, the lands that have been ravaged, abused, and used for their resources; we are here to rehabilitate those once wild places. This is the regenerative work of our times.

With regenerative design, we turn problems into solutions. We regrow the forests, we build topsoil, and we transform waste into ecosystems.

### ***Weaving the Threads Together***

Now you have the context of some of earth's wisdom, the state of the landscape industry, principles of regenerative design, and hopefully, the continued willingness to restore landscapes.

Where humans have been a problem, where our land-use practices have destroyed ecology—now we restore the land. As you strive forward in this book, take with you the design intelligence of the earth. In your design process, be the forest, be the watershed, be good fire, consider yourself a keystone species, and aid every landscape you walk along with your support.

A regenerative landscaper is a weaver of earth’s living processes. Never forget that when you design, build, or maintain a landscape, you are making decisions that affect the whole ecosystem and the future of life in that place. Where you locate elements, what you choose to destroy and what you choose to leave unharmed, your interaction with water and sun—all of these are threads in the tapestry you are weaving onto the land. Focus on the connections (most importantly, your own) and, above all, never stop listening to what the land is telling you.

Up ahead, all the threads of the regenerative landscape will be revealed, and by the end of this book, you’ll have everything you need to expertly design and build regenerative landscapes.

## LAWN TRANSFORMATION STEP BY STEP

**Step 1: Analysis and Design.** Every lawn project, no matter the scale, requires an investment of observation, context analysis, and design before work can commence. In *very* small projects that time may only be an hour of planning, whereas larger projects can take much longer.

For lawn conversion, you need address these questions:

If an irrigation system is required, does the irrigation system need to be converted from sprinklers to drip?

What kind of soil are you working with? How much compost and other soil amendments will be needed for the lawn transformation?

What kind of planting systems are replacing the lawn? Are larger plants (five-gallon or larger) going to be planted?

Are earthworks or other terraforming needed to achieve a water-wise design?

**Step 2: Excavate Edges (When Appropriate).** The first step in lawn transformation work is preparing the site for sheet mulching. If the existing lawn is growing up to hard edges (concrete walkway, steel or rock edging, patio), it will be necessary to dig those edges out to ensure that sheet mulching materials (compost, cardboard, wood chips) don’t slide onto hard surfaces.

Dig the sides out as if excavating a shallow trench. I suggest digging down four to six inches and a foot in width. In most cases the material you dig out is spread or “feathered” over the top of the lawn area adjacent to the edges. Excavate edges in this way to allow for compost, cardboard, and mulch placed such that the final grade of mulch rests at the same grade, or level, as the edging materials. In this way, mulch won’t slide onto pathways and patios.

**Step 3: Earthworks, Hardscaping (Optional).** If the design calls for any kind of earthworks or hardscaping, this would be the time to do it. Most lawn transformations (at least those on

a tight budget) will not call for drastic changes to the topography, but we *always* design to the context of a site and rain gardens, pathways, ponds, will be appropriate for some projects. If your project calls for elements that involve changing the topography or installation of architectural elements, the excavation, grading, and foundations for these systems are best implemented at this phase of the project.

**Step 4: Renovate the Irrigation System.** In drier climates, all lawns will have an irrigation system. Sprinklers are preferred by most lawn installers, and these systems will need to be renovated at this phase. There are simple conversions that allow you to easily cap sprinkler heads and convert the sprinkler system to a drip system for your new landscape. Conversion kits are fast and affordable and keep you from having to make new connections to water lines and irrigation manifolds (unless manifolds need attention!).

For some projects, a new irrigation system may need to be assembled. In that case, make sure any trenches, excavating, pipe/timer wire placement, and valve manifold development is complete at this phase of the project.

**Step 5: Compost and Mulch Placement.** This is where the process gets seriously fun. After transforming hundreds of thousands of square feet of lawns over the years, I can confirm that digging out and removing grass is *not* the most effective approach to lawn conversion. Remember, the main goal of regenerative landscaping is to increase the ecological health of environments through building living soil, water infiltration systems, and habitat enhancement. Always seek to do the least harm during project installation.

That is why we leave the grass in place whenever possible and use the sheet mulching method to turn the lawn into a soil building system, feeding soil microorganisms with organic matter by decomposing the leaves and roots of the lawn. If you are concerned about chemicals previously used on the grass, bioremediation (using mushrooms, bacteria, and plants to remove toxins) can be incorporated into the sheet mulching and planting plan to clean toxic soils. In some cases, the soil is contaminated with lead and *does* need to be removed if vegetables need to be planted there. Otherwise. . . .

**Lawn Sheet Mulching.** At this phase of the project, all the edges should be excavated and soil grades finalized, all trenches need to be filled, and any new hardscapes inside the area installed.

**Place Compost.** For the greatest carbon sequestering and biological activity in the soil, use enough compost to cover the whole lawn area in a minimum of two inches. This is the first layer of material to be placed and gets put *directly* on the grass (it sounds crazy but it works!). If the budget doesn't allow for this expense or planting will be delayed for an extended amount

(continued)

of time (more than six months after sheet mulching), then skip adding compost at this phase. Compost can also be added to the root zones of plants during the planting phase.

**Place Cardboard.** Acquire enough cardboard and/or newspaper to cover the lawn area entirely. If newspaper is what you have on hand, make sure to use it in layers at least eight pages thick. Cardboard and newspaper should be placed over the compost-covered lawn and overlapped at all edges by two or more inches. Most cardboard and newspaper can be resourced for free. Bicycle shops, solar installers, appliance stores are all great sources for recycled cardboard that would otherwise become waste. For large projects, at my company Permaculture Artisans, we purchase rolls of recycled cardboard from paper and packaging companies. For reclaimed cardboard, remove tape and make sure to *wet thoroughly* at the time of installation.

**Place Mulch.** Compost is down, cardboard is placed on top, and now it's time to cover the cardboard with mulch. Wood chips are the best choice if they are available in your bioregion. Straw, leaves, and plant debris (though this last option is not aesthetic if you are doing this for a client) are all good options if wood chips are not available or are too expensive.

Place mulch at a depth of at least four to six inches, making sure the mulch material doesn't rise above the grade at any hard edge (walkways, patios) of the worksite. Ensure that *all* cardboard/newspaper is *completely* covered with mulch. Any cardboard material not covered will dry out and could cause small problems later on.

**Step 6: Planting Systems.** Yay! If you have come this far in your project, you have made it to the planting phase. If you are planting trees or plants that come in 15-gallon pots or larger, you may want to plant those at the beginning of Step 5, after you have placed compost but *before* you put down cardboard. We plant large plants before mulching because it can be difficult to go back and dig large holes through the mulch. For 5-gallon pot size plantings or smaller, it is better to mulch before planting.

Use planting best practices when putting shrubs and trees into the ground. This may include adding mycorrhizal fungi inoculants, soaking with compost teas, adding soil amendments such as oyster shell and rock dust, or protection such as gopher wire baskets or tree guards.

**Plant Placement.** Before you put plants in the ground, first place them where you want them or how they are shown on a planting plan. When you place plants prior to planting (say that 10 times fast), dig a hole in the mulch and cut the cardboard beneath (an X cut works well), then place the plant there, still in its pot. We do this because plant installers sometimes get confused and plant next to the original placement rather than in the exact spot. Don't ask

me why it happens, but it is common and should be avoided. Also, it is always a best practice to lay all plant materials on the ground to make sure placement is aesthetic and functional before final plant installation.

**Step 7: Final Irrigation Install.** The final step in your lawn transformation project is completing the irrigation system. In Step 1, you should have converted or renovated the irrigation infrastructure (hard lines, valves, timers, filters). In this final step of the process, you need to run drip hose out to your plants if you live in a climate that requires irrigation in dry months. If transforming your lawn into a native or drought-tolerant landscape, you can plant at the appropriate time of year and some of your plantings may not require any irrigation, but in most cases supplemental water is needed in the first couple years.

In chapter 31, you can find complete details for building an irrigation system. For now, know that this phase of your transformation will be running drip hoses to plants, installing emitters or using in-line drip (drip hose with built-in emitters), and burying drip hose in the mulch. Once you've run all your drip lines and buried them, you must check the irrigation system for leaks and pressure. Turn everything on (one valve at a time) and make sure the system is working correctly.

**Step 8: Monitoring.** For a few months to year after planting, monitor the landscape closely. Make sure your plants look healthy and that no cardboard has become exposed. If you find exposed cardboard, cover it immediately with more mulch. You may want to add compost tea applications in the first few months to keep the plant community happy during their transition into the newly transformed landscape.