The Design Pathway for Regenerating Earth

By Joe Brewer

Draft Manuscript in Progress
When the earth is sick and dying,  
There will come a tribe of people  
From all races...  

Who will put their faith in deeds,  
Not words, and make the planet  
Green again...
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Preface

This is a book about what will need to happen if humanity is to intentionally avoid extinction. It is a disturbing truth that our current trajectory includes the real possibility that we could fail to meet this objective—and as a result bring about our own demise.

I begin this hopeful treatise with such a somber message because I honestly believe that those of us who embody this intention will need to become highly skilled at discerning what is happening in the real world. We must take care not to sugarcoat the seriousness of our present predicament. Nor should we presume that our demise is already guaranteed. The people who study existential risk (threats to our existence as a species) are well aware that it is easy to project too strong a consequence on any given cause that might do massive harm to humans.

At the same time, there are pitfalls that enable many people to believe things are better than they actually are. One story along these lines is the notion that we have until the year 2030 to bring greenhouse gas emissions in check to avoid catastrophic climate change. Study a little about “abrupt” patterns of climate change and you will see that we are already a few decades too late for this. One sobering example is the shutdown of the Sahel Monsoon in Sub-Saharan Africa that took place in the late 1960’s. It is now known to be caused by the burning of coal in England, France, and Germany during early industrialization between roughly 1870 and the 1940’s. This shutdown caused widespread drought, collapse of regional food production, and the ensuing starvation combined with resource conflicts and genocides of the region in the last few decades of the 20th Century.

Catastrophic climate change has already occurred in some parts of the world. It happened before I was born and has continued throughout my lifetime (and yours) without us being aware that this was the case. If we were unable to discern this reality, what other truths are we missing? How might the stories we tell ourselves be misleading, incomplete, or downright wrong?

This challenge of discernment applies equally well to how we understand what does work for addressing our planetary predicament. There is a growing awareness that the extent of deforestation is a significant contributor to the drying out of landscapes, increased risk of landslides, and loss of carbon to the atmosphere. Campaigns have been launched to “plant a billion trees” and restore health to the Earth. Yet those with ecological training will observe that there is a profound functional difference between what are effectively giant monoculture tree farms—like so many of the “forests” in the Pacific Northwest of the United States comprised mainly of Douglas Firs—and real forest ecosystems that have gone through the stages of ecological succession while increasing the number of interrelated niches for diverse species to co-exist within them.

Planting a lot of trees is another expression of the machine metaphor for nature that seeks to execute a simple protocol to restore landscape functions. The co-creative dance of growing
within a developing forest ecosystem is more like realizing we are part of a family web comprised of many brother and sister species of plants, animals, fungi, and bacteria all orchestrating themselves and each other into harmonious interdependencies that allow their resilience to come alive. This kind of distinction can be found in many other presumed solutions that won’t work because they are not adequately contextualized or clearly enough understood to see what the truly systemic alternatives need to be.

The old adage tells us that we must have the courage to change what can be changed and the wisdom to separate wheat from chaff to discern what might yet be changed. The regeneration of Earth is a process that humanity needs to enact in the middle of a planetary-scale collapse. Some things cannot be changed, like the fact that catastrophic climate disruptions have already caused widespread human suffering. Other things—one might say—should never have been allowed to happen in the first place, like the invention of the Haber-Bosch process for manufacturing synthetic fertilizers that enabled the human population to grow billions beyond our carrying capacity.

Yet also there is a horizon of hope beyond the despair that deserves to be recognized and honored. We truly can do something worthwhile for our descendants that is worthy of these times. What must be done—and how to do it—is the subject matter of this book. Together we will explore how to regenerate the Earth and safeguard humanity’s future.

Are you ready? There’s no time to waste. Let us begin.

**Chapter 1 — The Cultural Evolution of Planetary Collapse**

Any well trained doctor will tell you that it is necessary to move beyond the treatment of symptoms to heal what actually causes the suffering within a patient. Root causes of an illness must be identified along with a rigorous understanding for how the involved systems of the body function together if a medical intervention is to work. Similarly, a skilled engineer will say that you have to understand the principles and processes involved in the design of structural solutions if you want their implementation to go according to plan.

We are immersed in a situation that is incredibly complex. Many causes are involved at the same time, operating at a multitude of scales in space and time and interacting in often unpredictable ways. A huge policy discourse has arisen around climate change, for example. But is it a cause of our woes or merely a symptom of something deeper? Is the size of the human population combined with excessive patterns of consumption a pre-determined strain on planetary resources? Or is it merely an unintended consequence of inadequate decision-making when dealing with an interdependent and increasingly globalized economy? Does the
exponential pace of technological change create new solutions? Or does it destabilize increasingly outdated systems so that they cannot be managed effectively?

This mental exercise is meant to give us pause. How can we possibly discern what is really going on when so much is beyond our ability to comprehend? Is there a “radical” surgery that gets to the root causes of planetary disruption? How might the root causes be discerned? What kinds of designed intervention might be up to the task of safeguarding humanity’s future?

Further still, when we talk about humanity’s future are we talking about keeping the human population elevated to levels higher than seven billion? Or might we need to think like planetary ecologists and attempt to discern the thresholds associated with carrying capacities that place truly viable human population counts at a much lower number?

All of this has to do with the cultural evolution of humanity and our relationship to the larger environmental contexts in which it has unfolded. I would like to take a few minutes and share the story that has emerged from careful deliberation and debate among anthropologists, evolutionary biologists, archaeologists, paleontologists, along with others in related fields of study that have made it possible to tell the human story in detail.

I will make the case that the current planetary overshoot-and-collapse took roots long ago in human history—even before our own species was birthed into an African savannah three or four hundred thousand years ago. Some might say the global crisis was caused by industrialism and the use of fossil fuels. Others outline the birth of agriculture roughly ten thousand years ago that made it possible to create complex hierarchical societies, some of which evolved into empires and civilizations. I go farther back in time and place the seeds of Earth disruption about three million years ago when our ancient ancestors (who were not anatomically modern humans, yet were still hominids) gained the distinct ability for conceptual metaphor.

These “tool-using” hominids could look at a wedge of rock and see in it a carving utensil. With careful striking motions against another rock, they could chip away at the material pieces that didn’t fit this mental mold until the wedge became manipulable with human hands to cut and slice whatever might be useful to human bodies. This early step in the externalization of a bodily function—in this case, using a carved rock to serve functions previously restricted to fingernails and teeth—enabled these Homo Habilis tool-users to scavenge food scraps more effectively and digest more nutritious calories with their enhanced implements of mastication.

When this occurred, something profound happened that is of a thermodynamic nature. The capacity to take energy and materials from the environment efficiently allowed more of it to be converted into the biomass of hominid bodies. A thermodynamic exchange took place that brought more of the external world into the creation of hominid livelihoods. According to the 2nd Law of Thermodynamics, which states that the entropy within a system can never go down during an exchange of energy, this had the effect that complexity in the environment was reduced so that complexity of human populations (measured in population numbers and biological organization) went up.
This process of simplifying environments to increase hominid biomass took another evolutionary leap about a million years later when other ancestors of ours gained the ability to control the use of fire. This irreversibly altered the course of human history because the emergence of cooking abilities took evolutionary selection pressure off one of the biggest energy drains of mammalian bodies—digestion—and therefore allowed the “energy gains” to gradually accumulate in the body’s other great energy hog, the brain.

Think about it this way. The two systems of bodies like ours that demand the greatest amount of energy are brains and intestines. Stand a gorilla next to a human today and you will notice some similarities in bone structure, shape of the hands, appearance of the eyes, and so forth. You will also notice that gorillas have a proportionally much larger gut than we do. This is because their intestinal tract is 40% longer when scaled for comparison with human bodies. Gorillas need a lot more guts to safely digest their food than we do.

The invention of fire was a cultural practice that fundamentally altered hominid social behaviors, as we will explore in more depth later in this story. It also relaxed the need to slowly digest foods in a tropical environment where parasites are commonplace. Cooked meat is already pre-digested and cleansed of dangerous bacteria, worms, and other microorganisms so that the digestive system doesn’t have to do as much work to get the energy and nutrients out of it.

These energy savings in the gut had the effect of relaxing selection pressure on the accumulation of energy-intensive nerve cells in the brain. This opened up the evolutionary pathway that built up into increasingly complex structures in the brains of hominid descendants. At the same time, just like with the cutting tools of their ancestors, the controlled use of fire could burn through the complex structures of a landscape and convert more of it into charred remains to convert into human bodies through consumption and digestion. Again, there was a pattern of reducing the complexity of the outside world to increase the complexity of hominid populations.

In those days, there weren’t enough hominids around to keep ecology at bay. The reductions in environmental complexity had the effect of accelerating ecological succession—the developmental pattern of sequential stages for ecosystems—in some contexts and so it didn’t have cumulative long-term effects. As we will see below, this changed dramatically when human population began to grow exponentially with the discovery and use of fossil fuels. From this later point onward, ecosystems became overwhelmed with the pace, scale, and intensity of environmental degradation wrought by human cultural practices.

This pattern of structural transformation is the basis of the planetary crisis we are living through today. The story continues at an accelerating pace—by recognizing that the increasing brain sizes of hominid descendants that accompanied the simplification of landscapes through controlled burns led to a special kind of “niche construction” that has since achieved what
Michael Tomasello calls a *ratchet effect* to scaffold the acceleration of cultural evolution in a parallel feedback loop with alterations in biology.

Let me unpack this a little bit.

The use of stone tools for cutting and slicing was a cultural innovation. Yet it enabled the biological evolution of its stone-tool users to take selection pressure away from sharp nails and teeth while increasing the fitness of the species as its population grew steadily (yet very slowly) over the next million years. Then the cultural innovation of cooking arose and took evolutionary pressure away from the biology of large intestinal tracts, making it possible for the increased energy and nutrient efficiencies that are required to grow larger brains.

A niche is an environmental structure that can be functionally used by an organism to increase its fitness. In some cases, like with birds that establish a nest, the niche may be used by one generation but must be rebuilt in future generations. Yet in other cases, like that of a beaver that builds its dam in such a way that river flows are persistently altered, the niche may be inherited by future generations that didn’t have to create it themselves.

For humans, we live today in elaborate built environments that slowly (and sometimes quickly) accumulated an increasing diversity of inheritable niches that none of us needed to build in our lifetimes. New Yorkers can take the subway designed and structured into their urban landscape by ancestors several generations back with a regimen of maintenance and gradual improvements that are manageable within existing constraints. This capacity to create niches and inherit them as built structures has a long history in our species as well. Among the many cultural innovations that were enabled by larger brains among hominids who increasingly organized themselves around cooking fires was the accumulation of conceptual language capacities that dramatically increased their aptitudes for communication and coordinated action.

Cooperation in the form of hunting parties, guided learning with instruction, passing along of previously vetted information, and other highly valuable expressions arose within the “social niches” of shared language groups. Those who learned the gestures, movements, and symbols of a given culture could inherit powerful capacities to further alter environments in ways that served the survival of hominid lines. This scaffolding of cultural development enabled cultures to grow increasingly elaborate and the alteration of environments to serve human needs grew with it.

From here the story becomes more convoluted—partly because it began to speed up and thus had more twists and turns, and partly because the ability to form social niches gave rise to a splendid diversity of human cultures when anatomically modern Homo Sapiens entered the scene. Jump ahead to 100,000 years ago and you will see the clear evidence for ritual burials, symbolic art, and spiritual worldviews in our ancestral line. Reconstructions of climatic and ecological history reveal a drama of continuous changes as humans entered new environments (like when all the megafauna of Australian and North America disappeared shortly after
humans arrived) as well as how human populations contended with rapidly changing environments when climate shifted dramatically (like when a new ice age took hold and forced migration from present-day Europe back into parts of northern Africa).

It wasn’t until the end of the last ice age—when a long-term and stable warm period began that lasted more than 10,000 years, a period known as the Holocene—that complex, densely populated, city-states and agrarian societies began to crop up in the fertile crescent of the Middle East, as well as in Northern Africa, Southeast Asia, and throughout Central America. The rise of empires and civilizations is a sweeping drama of the Holocene period that eventually enabled a planetary-scale economic system to arise in the last 500 years. It is this planetary system that has allowed us to cross numerous planetary boundaries and destabilized the self-regulating processes of the Earth itself.

This part of the story is where the “planetary” in planetary predicament becomes emphatic.

All empires and civilizations throughout the Holocene have undergone diverse expressions of collapse. Some were followed by quick rebounds in slightly altered form while others decimated their landscapes so much that they remain harsh, barren deserts many thousands of years later. Yet it wasn’t until the frontier conquest of America by European monarchies that the globalized system took hold—allowing specific cultural models of extraction to take root in the colonial systems of wealth hoarding they constructed. This was amplified massively when fossil fuels began to be utilized to support the emergence of the Earth’s first globalized human economy with greatly enhanced capacities to reduce the complexity of non-human ecosystems by transforming them into increasingly complex human social systems.

All of the wealth inherent in our globalized economy came at the expense of degraded landscapes so normalized today that most of us privileged enough to fly don’t even look out the window of our fossil-fueled airplanes to introspect down onto the fenced off patches of deforested Earth. These fields of degradation have long since replaced the resilient meshwork of ecosystems that were consumed by extractive human cultures in the last few millennia.

Thus we have the depletion of soils, accelerating loss of non-human species, intensifying destabilization of planetary climate, and all the other environmental ills that define our predicament in the 21st Century. I call this runaway cultural evolution because the ratchet effects of social niche construction and scaffolded cultural development have achieved the breakout of an exponential growth in pace, scale, and complexity for the globalized economy that all of us live within in some form or another today.

Cultural evolution in the hominin line began to differentiate itself from the mechanisms of biological evolution about three million years ago. Increasingly the “dual-inheritance” of culture and biology together enabled a third inheritance system to arise in the altered social and ecological structures of niches that could be built upon from one generation to the next. This enabled the process to become self-amplifying until it achieved exponential take-off and has
proven itself to be a force of geological significance as a subset of human cultures gained the ability to alter Earth Systems and destabilize the entire biosphere of our home planet.

Understanding the interdependent functions of this biology-culture-niche feedback system is key to designing for the restoration of systemic health for the Earth. Like the doctor who works to address root causes or the engineer who carefully takes the time to learn the principles and processes involved in their designs, those of us seeking to regenerate the Earth will need to hold this complex dynamic of cultural evolution in mind as we go about our work of restoring vital ecological functions to the landscapes that provide for our livelihoods.

We are in the midst of runaway cultural evolution. It is not the burning of fossil fuels or the spread of consumer marketing (or any of a host of other causes comprising subsets of the overall system) that we need to address. More deeply, we must learn how to mindfully design social niches so that they co-evolve with our inherited biological and cultural heritages to participate in the natural ecological processes of regeneration that Earth’s biosphere already knows how to do much better than we do.

With this in mind, let us continue. There is still more ground to cover and we have a lot of regenerative work that needs to be done.

**Chapter 2 — Are We REALLY In Planetary Collapse?**

This book started off with a claim that warrants careful elaboration. Is it really the case that we are already in planetary overshoot-and-collapse? The mental image that comes to mind for many people when considering this idea is one of warfare, starvation, and loss of human life. It tends to be thought of in anthropocentric terms and imagined as a singular historic event—like a Hollywood drama taking place in a small amount of time and transpiring with a flood of intensity.

Real societal collapses don’t work this way. Researchers who study the fall of Rome will tell you that there were stages and cycles, advancements and retreats, ebbs and flows of social complexity rising and falling over the span of several centuries. Even with “simpler” cases like Easter Island, the dynamics played out over more than one human generation and had enough nuances involved that archaeologists remain vexed about many of the details for what actually happened.

Planetary collapses are even more remote from this imagined scenario and are of a qualitatively different level of complexity that makes them even harder to visualize. In the workshops I have given on this topic, I begin with the provocative claim that no human mind is capable of fully grasping what a planetary collapse is. So how can I paradoxically assert that we know we are already in the middle of one?
That is the topic we come to now. For if we are to regenerate the Earth, we must carefully discern where we are in the process and what the ground truths are for what can and cannot be avoided in the next few decades. My objective in this chapter is not to fully describe what a planetary collapse is. That would be at odds with what I claimed in the previous paragraph about how incomprehensible and intractable this topic is with its overwhelming complexities. I have been studying and attempting to manage different aspects of planetary evolution for twenty years and I have only glimpsed the contours of this massive beast because it defies perception in so many ways.

Instead my objective will be to help you cultivate a sensibility about what planetary collapse is like so that you can practice discerning it in your daily life. Efforts to regenerate the Earth will call upon many sensible people working together as they navigate the complexities of planetary change. All of us must learn how to remain in open dialogue and critical inquiry with the world around us as it repeatedly shifts the ground beneath our feet.

With this in mind, let us continue.

Students of Earth’s history will be aware that it is 4.5 billion years old, has had continuous life on it for 3.8 billion years, and is divided into epochs that last millions of years as the planet goes through dramatic changes over incomprehensible spans of time. We will need to try practicing the humility that such vastness evokes as we seek to make sense of this Sixth Mass Extinction Event that is being caused by runaway cultural evolution in the human lineage.

Those seeking to dismiss the findings of climate science often do the sleight-of-hand trick of employing cherry-picked research from the very same field they seek to condemn as useless by describing how Earth’s climate has always been changing. This is true, of course. The climate system is a dynamic meshwork of interacting processes that remains far from equilibrium—so it is literally true that it is, at some level, always changing. Yet this insight totally fails to acknowledge how the only way 10,000+ climate scientists can explain the observed warming trends of the atmosphere is to include the burning of fossil fuels and altering of landscapes caused by human activities for their models to track the observational record. This together with the vast diversity of data trends showing how the Great Acceleration has come to dominate planetary evolution. Together they provide incontrovertible evidence that humans are causing the planetary destabilization so clearly visible in datasets for carbon dioxide levels, changing acidity of the world ocean, and other key empirical trends like biodiversity loss, erosion of topsoils, and micro plastics filling every available water supply on Earth.

For our purposes, we need to accept this validated finding from climate science and then go deeper in what studies of earth systems have to tell us about the last five or six million years. When we do this we begin to discover that our common ancestor with other great apes parted ways around this time. Climate change was one of the driving factors as central and eastern Africa dried out causing jungles to give way to mixed landscapes of patchy woodlands, marshy lakes, and grassy savannas.
As these hominid ancestors began their long walk towards unleashing cultural evolution onto the Earth, another geologic activity was underway that would have a profound influence on the kinds of humans that emerged throughout the process. Plate tectonics was moving North and South America toward each other until about four million years ago when they slid together to form the isthmus of what is now Central America. When this happened, there was a profound reshaping of planetary climate that emerged because the equatorial flow of ocean water between these continents was forced to gush poleward around the southern tip of Argentina—creating a huge thermal pump that carried heat toward the poles as it moved along in the ocean currents.

Thus began the Age of Ice Ages. Our ancestors had to contend with dramatic shifts in planetary climate as ice sheets formed, lowering the world ocean and profoundly altering the contours of air, water and land. They learned how to adapt to these changes while also struggling when the opposite transpired. Ice sheets would recede and ocean levels then rose accordingly. The Earth became a crucible of planetary instability with long periods of ice age drought (precipitation goes down when fresh water gets locked in mile-high sheets of ice) lasting hundreds of thousands of years, followed by briefer and more turbulent periods of intermittent warmth that ranged from a few to a few dozen thousand years before another ice age commenced.

All of this came to an end—if geologist William Ruddiman is correct—when humans achieved their modern form in the most recent ice age. Several human cultures learned how to develop agricultural systems for a new social model of empire during the warm and stable period of the Holocene after this most recent ice age came to an end. Ruddiman is one of the scientists who helped confirm that the ‘Milankovitch Cycles’ of parameters for geometric relationships between Earth and Sun were in fact what drove the ice age dynamics of these last few million years. He calculated when the Holocene should have come to an end based on these parameters and noted that the next ice age was delayed in coming by several thousand years.

He then ran the calculations for how many greenhouse gases were released into the atmosphere from the slow changes in landscapes from human use—a roughly four-thousand year period of time when a significant portion of the Earth was deforested and converted into agriculture and housing for all of the city-states that grew during this time. This was a gradual process involving all of the Holocene empires on Earth. What he discovered, creating quite a controversy among his colleagues until it gradually came to be accepted as more research ensued, was that human activities during the Holocene were very likely to have brought the Age of Ice Ages to an end.

Imagine this: human-caused climate change responsible for stopping the next ice age from taking hold. And it happened between 8,000 and 4,000 years ago. Our collective impacts on the planet were strong enough in aggregate to overcome the thermal pump of the world ocean pulling heat around South America on a daily basis combined with changing geographic patterns of solar energy across the latitudes of the planet that drove the expansion and recession of ice ages for two and a half million years.
If human cultures could alter landscapes on such a scale in 4,000 years, imagine what we have managed to do when we started burning coal and oil that took 200 million years to form (and which we will have nearly burned through in six orders of magnitude less time—a mere 200 years). The losses in biodiversity, alterations to compositional landscapes, and shifted trajectories of planetary processes have been building up for quite some time. What has happened roughly since the birth of industrialism is the supercharging of an existing pattern that had been growing in strength for tens of thousands of years.

So when we talk about planetary collapse, as we will now, it is vital to keep in mind that there are nested levels of influence that are all happening together. Some take years or decades. Others take centuries or millennia. And they interact with each other through a plurality of feedbacks that count in the thousands, possibly millions, when we take the time to zoom in and see what is really going on.

I like to use the framework of Planetary Boundaries to help make planetary collapse feel more graspable. It was developed by a community of earth system scientists through the coordinating efforts of the Stockholm Resilience Centre. They asked a very powerful question. *How do we define a safe operating space for humanity with all that is currently known about how the Earth’s various systems function and interact with each other?* This question led them to a list of nine key processes that have some calculated or yet-to-be-determined threshold that if crossed would make human civilization untenable at planetary scales.

Let me say this more plainly. There are nine critical thresholds—each for a key dynamic pattern of the Earth—that together define a safe operating space for humanity. The thresholds are for biosphere integrity, climate change, land-system change, freshwater use, biogeochemical flows of nitrogen and phosphorous, ocean acidification, atmospheric aerosol loading, stratospheric ozone depletion, and a catch-all category for unimagined risks called novel entities. If even one of these critical thresholds is crossed, it is game over for globalized humanity.

Some of the planetary boundaries are well understood. Others are wrought with uncertainties. It is possible that no single threshold exists for a few of them. But the act of creating such a list naturally begs a follow-up question: *If there are nine boundaries, and even the crossing of one is too much, HOW MANY have we ALREADY CROSSED?* This was answered in a peer-review paper published in 2011.

Four. We have already crossed four of them.

The take home message from this exercise is that we are already in planetary overshoot-and-collapse. What are the four boundaries that have already been crossed? The extinction rate of species in biosphere integrity; loss of ecological complexity in landscapes due to land-system change; geochemical cycling of nitrogen and phosphorous due to fertilizer use in industrial agriculture; and climate change mainly due to the combustion of fossil fuels and the land-system changes just mentioned.
We have overshot the Earth’s ability to regulate itself in these domains of planetary function. And collapse patterns are evident in domains of stability that previously existed but are stable no more. These domains of stability are no longer tenable as the four dynamics interact and accentuate each other while humans accelerate our impacts in all of them at an exponential rate. Not only have we crossed four planetary boundaries, but the impacts grow daily and are driving us farther from the safe zone of stability that would be necessary to continue having complex societies on Earth.

When I talk about how we are already in planetary collapse, this is what I am talking about in ecological terms. Yet there are other dynamic patterns within human societies that are also in play. The collapse of real economic activities as debt-bubbles of financial speculation ballooned to represent 80% of the global economy. The collapse of ecoliteracy as a majority of humans now live in cities and have effectively zero contact with healthy ecosystems at any point in their lives. The collapse of functioning democracies as wealth hoarding and structural inequality enable billions to be spent on election propaganda to buy political outcomes. And so forth.

Continue adding more of these patterns to the story of global change and it quickly becomes overwhelming—which is why I suggest that no single human mind is capable of comprehending it all. We are going to need to trust in others as they see parts of the system emerging beyond our own awareness. There is a significant mangle of issues that merge individual discernment with collective capacities to make effective decisions.

We are going to need to learn how to learn together as we navigate the maelstrom of planetary collapse for the rest of our lives.

Chapter 3 — Are You Saying Humans Are Bad for the Planet?

Taking stock of what has been said so far, it could easily begin to feel like I am describing how destructive and harmful humans are to our home planet and thus I believe we are something like a disease or plague that is inflicting pain on the Earth’s biosphere. This is an area where great care is needed to practice ethical discernment about what the science of evolution has to tell us regarding the way things work.

As sophisticated as the story is up to this point, I have still brushed in broad strokes and left out a great many important details. One of which is the vitally important observation that cultural diversity in human societies throughout the history of our species must be reflected on carefully as we assess the nature of humanity in ethical terms. The growth of empires and civilizations during the Holocene is a process that competed with and in subtle ways internalized aspects of many indigenous cultures that were assimilated, displaced, or destroyed along the way.

I have painted the contours of ecological collapse due to human culture. Let me now paint a contour of ecological integration and resilience due to human culture. Students of
permaculture, landscape restoration, conservation biology, and all related domains of management where humans co-create as part of a larger ecological web will know that it is possible to have a net positive effect on living systems at both small and large scales. Perhaps the most dramatic example of this is the Amazon Rainforest of South America.

Cultural anthropology is filled with detailed ethnographic case studies of indigenous peoples living in this vast jungle of branching waterways and mountain contours. The Amazon is known to be the home for millions of species and hundreds of human cultural groups. Diversity is the lesson; uniformity an illusion. One of the paradoxical insights about the Amazon is that its many banks are sources of downriver erosion that pull nutrients away from the ground. Thus it should be a place of poor soil quality due to these hydrological processes.

And yet there is terra preta, the most productive and healthiest type of soil on Earth. This black soil runs deep along the shores and inland jungle areas of the Amazon. It enables an incredible richness of life to thrive in the mixed ecosystems of jungle and river. By geologic accounts alone, it shouldn’t be there. But it is. Terra preta is a human innovation—grown through cultural adaptations for how to compost biomass and improve the productivity of soils in a region that has had human occupants for at least ten thousand years.

Zoom out to the landscape scale, as one might do by flying over parts of the Amazon with surveillance aircraft equipped with remote sensing equipment, and you will learn that the canopy structure of the forests reveal the touch of human hands. The composition, layered structure, and productive qualities of the Amazon rainforests reveal that the species of plants thriving there have been selected and enhanced for human use over the span of several thousand years to increase the number of people capable of living and thriving there.

Said another way, the Amazon is a food forest. It is what permaculture designers might call a climax ecosystem that maximizes human yields by working with the living systems of the land in a harmonious way. There are more species of plants with beneficial uses for humans than would have been the case if humans had not dispersed the seeds, selectively pruned the forest canopy, and shaped it for human subsistence.

Humans can be good for a forest.

Herein lies the paradox. Cultural evolution can lead to seemingly magical functional harmonies between humans and their environments. The Amazon is in subtle ways a built environment just as profoundly as New York, yet is built on very different metaphors, ethical relationships, and functional objectives. Humans have such diverse cultural capacities that we can nurture life on scales as large as the biggest river system on Earth while we are also capable of destabilizing our home planet’s biosphere in such a way that it could bring about our own extinction.

Are we bad for the planet? It depends on what kinds of cultural systems spread out across all the diversity of human creativity. We have a statistical problem before us. The small number of cultures built on assumptions about human separation from (and domination over) the natural
world have managed to unleash exponential and cumulative cultural powers that destroy ecosystems at all scales. Yet there are also a large number of small-scale societies that have had more mixed relational successes with their surroundings. Not all indigenous cultures are sustainable. But all human cultures that have been demonstrated to be sustainable so far are indigenous.

Stop and let that sink in. I am not presenting the illusory tale of the noble savage here. It is not the case that some idealistic stereotype has ever existed of peaceful humans living in a Garden of Eden. Violence and conflict, environmental destruction, harms of many kinds have been part of the human drama in both small and large-scale societies. And yet there have emerged on occasion a confluence of cultural adaptations to specific places capable of achieving stability and sustainable existence for multi-thousand year stretches of time.

I am telling the story in this way because I want to increase our capacity for ethical discernment. Many ideological judgements exist about what makes a society work and how “good” or “bad” it is with respect to often unconsciously accepted beliefs about the values and ethical norms involved. When we begin to explore the design of regenerative cultures, this kind of ethical baggage is going to get in our way. So let us begin to practice dealing with it now.

While it is the case historically that no empires or civilizations have ever demonstrated a capacity for sustainability— all of them have gone through boom-bust cycles of growth and expansion followed by eventual collapse—it is also the case that most human cultures have gone away with the passage of time. This is analogous to the biological observation that more than 99% of all species in Earth’s 3.8 billion year history of life have gone extinct. A similar assessment could be made to show that human cultures emerge and disappear with changing environmental contexts in such a way that nearly all of them are extinct today.

We cannot simply say indigenous = good as a design criteria. The way most of us have been taught to construct categories is to treat them as lists of criteria comprising the necessary-and-sufficient conditions to be part of that category. This is how a large part of Western philosophy has been built up in the last two thousand years. One of the most revolutionary aspects of Charles Darwin’s work was to target this notion of universal (and permanent) categories as fundamentally incorrect when it pertains to the concept of species in biology. Prior to his articulation of descent-with-modification it was common to say “a lion is always a lion” because it meets specific criteria for being included in the category of lions.

What we need to realize is that there is a vital difference between (a) philosophical categories of good and bad as they relate to the functioning of societies; and (b) the dynamic interactions of effective functionality between human cultures and their environments. This is most confusing when talking about what is adaptive in a given situation. Something is adaptive if it increases the biological success of an organism in its environment—or rather this is what it means in traditional biological discourse. For cultures to be adaptive, it gets even more confusing (the history of biology is filled with contentious debates about this concept because it is so tricky to deal with in both practical and theoretical terms). Cultures can be adaptive to
their ecological contexts. But as we explored in the first chapter, cultures change their ecological contexts and emerge as social niches that are part of these contexts.

A specific cultural feature might be adaptive to the culture itself on shorter timeframes while being maladaptive with larger ecological systems on longer timeframes. For example, I might create a business that is well suited to thrive in a consumer market economy in the short-term while increasing the rate of depletion for vital resources needed for the consumer market economy to exist in the long term. We will explore nuances like this in more depth later. For now, I merely want to express that good and bad is not the same thing as adaptive and maladaptive.

Ethical discernment is hard, but it is essential that we get it right so our design interventions at least have a chance of working.

With that in mind, let us close this chapter by stating that I do not see humans as inherently good or bad. What I do see is that we can study which cultures have co-evolved with their environments to create resilience and sustainability and which cultures have not. This distinction is much more important for the future survival of humanity as we strive to regenerate the Earth.

**Chapter 4 —Let’s Talk About Regenerative Design**

We are now at a point where we can begin in earnest the conversation about how to design for regeneration of the Earth. Let me summarize the main points so far:

1. The root cause of planetary collapse is a cultural evolutionary process of niche formation that enables human social complexity to grow exponentially while biosphere complexity declines at a matching pace.
2. We are in planetary collapse and can prioritize four planetary boundaries already crossed—biosphere integrity, land-system change, geochemical cycles of nitrogen and phosphorous, and climate change—to get back within the safe operating range for humanity.
3. Ethical discernment is vital for design interventions to work and special attention should focus on which aspects of cultural systems are related to functional adaptive fitness to specific environments as we begin our design efforts.

This is already a lot to take in. Readers are not expected to fully grasp how cultural evolution works at this point in the process. Nor are you expected to know enough about interdependent patterns within the dynamic Earth system to apply design thinking that alters the course of cultural evolution. We will build up these capacities as we continue through later chapters—and, in full honestly, in our embodied efforts to enact regenerative designs in the world throughout the rest of our lives—so don’t worry if you are still a little confused.
I am trying to sequence these chapters so that we can walk together on a path that has never been taken before by any other human being. This means I must admit as the author that I am describing a design pathway that I also have never enacted. Our predicament is so dire, and time is so short, that none of us can wait for someone to field-test the process and show us how to do the work. Instead we have to make the path by walking it as the author Antonio Machado has said.

Let us begin a conversation about regenerative design.

Regeneration is what all living systems do as they create the conditions conducive to life (in the words of biomimicry expert Janine Benyus). I will give a concrete example and then explain in general terms. Every skin cell in your body dies within thirty days. When you look at another person—no matter how youthful, sexy, or vibrantly alive they appear—all of the skin that you see is dead cells. This is because the fatty subcutaneous tissues below the skin surface are continuously producing new cells that push upward and become layered into a substrate that is comprised solely of dead skin cells on the outer surface.

Skin is a membrane that regulates temperature, transports water and other nutrients, and is fundamentally involved in your survival every moment of every day. Yet it is continuously regenerating itself on a thirty day cycle. You take in energy and nutrients through the food you eat and water you drink to enable this process to continue for the entirety of your life—from the moment you are born to the moment you die.

Chilean philosophers and scientists, Humberto Maturana and Francisco Varela, gave this process a name. They articulated with rigor and precision what the pattern is like that defines being alive. The latin word they use is autopoiesis—the same root words for “self” and “the ability to express” as used in the related word poetry. This is the dynamic pattern of creating the conditions to express one’s self again. In every moment. As a living process. Until it ceases when we die. This is what regeneration is all about.

Relatively simple organisms exhibit this pattern. A single-celled creature like the paramecium will seek food, avoid toxins, and engage in behaviors that perpetuate its aliveness from moment to moment. The same is true for an ant colony with a million inhabitants. It self-organizes its search activities to maintain a continuous input of material nutrients by laying down chemical pathways for member ants to find, harvest, process, and dispose of wastes from its core metabolic processes.

You might notice that regeneration is a dynamic pattern that achieves sustained livelihood on an ongoing basis. Sustainability is, in this sense, a by-product of regenerative processes. If humanity is to continue existing as part of the Earth, it is because we live out our expressions in a manner that creates the conditions for our aliveness in every moment as this existence persists. The environmental discourse has gone through fads of labeling—called environmentalism in the early days, then sustainability later on. The focus on regeneration is
not a new label. It is a scientifically rigorous concept for how to achieve sustainability in our environmental practices.

When we talk about regenerative design, it is the intentional use of knowledge and tools to create solutions by making use of regeneration that is inherent to all living systems. Thus regenerative design is collaborative and co-creative. It is a dance with life. A theatrical performance enacted by living beings. A way to create the conditions conducive to life at all appropriate scales.

Regeneration for the Earth is about scaling up all of our local efforts in a sufficiently integrated way that we restore and maintain some shared sensibility about what it means to have planetary health. We cannot engage in regenerative design for the entire planet without coming to agreements about root causes of our present predicament, shared intentions for the future evolution of the Earth, and shared understandings about how local efforts scale up (and global efforts scale down) across all of the systems involved in our collective design efforts.

I felt motivated to write this book because I have read hundreds of other books about sustainability to see if I could discern a viable pathway for regenerative design. Every time I read one of these books, I felt like something was missing. Yes there were deep insights about the systems involved. Knowledge was evident for all of the essential parts. But there wasn’t a concrete pathway we could all walk together that explained how to actually do it.

So now we must learn how to apply regenerative design—together with all that is known about cultural evolution and earth systems—to find this pathway.

Others have described what regenerative design is much better than me and I would like to defer to them now. You can read books like Designing Regenerative Cultures by Daniel Christian Wahl; Regenerative Development and Design by Pamela Mang, Ben Haggard, and the Regenesis Group; Regenerative Design for Sustainable Development by John Lyle; Introduction to Permaculture by Bill Mollison; and an ever-increasing number of other titles that are now available.

My intention in writing this book is not to repeat the steps taken by these authors. They have done fantastic work and it all needs to be integrated across our efforts. What I hope to achieve is the articulation of the design pathway we all need to walk together. I will focus on the concept of scale-linking that was first described in detail in Sim Van Der Ryn and Stuart Cowan’s foundational work Ecological Design. How do we take all that is known about regeneration in living systems and weave the threads of nested systems to restore the health of local landscapes and rebalance the destabilized patterns of planetary systems at the same time?

Regenerative design can be done to bring a river back to life. It can restore the health and vitality of an individual person and their family. It can transform grief and trauma into vital pathways of healing restoration to people, communities, and ecosystems. Our task in the next few decades is to direct regenerative design toward the restoration of planetary health.
But how do we do that?

Planetary health is necessarily a hubristic phrase. Let us start with that. What we actually mean is planetary health that is conducive to human life in a manner that supports complex social systems for our species. We need to acknowledge this bias if we are to proceed. Those of us regenerating the Earth will either do so because we want humans to stick around or because we want some other species to stick around. As I write this book, my family is considering whether we will devote our lives to a specific biome—the tropical dry forest—as an ecosystem worthy of continuing its existence as part of the Earth. This is a design choice and we haven’t committed ourselves yet. I share our unresolved thought process because it shows how difficult it might be for a critical mass of people to agree about what is worth regenerating in the next 50-100 years.

Negotiating the goals of regenerative design will not be easy. Yet it will ultimately determine what we mean by regenerative design as those of us who feel the call to service come to organize our lives around what we hope to achieve. In this way, we can discover sources of empowerment and meaning that are in profound ways a part of regenerative design. We feel alive when we are regenerative, so naturally we feel most alive when engaging in regenerative designs.

We will explore more about what regenerative design is as we continue. Let us know begin to unpack what a viable design pathway for restoring planetary health might look like.

**Chapter 5 — Design Pathways for Earth Regeneration**

I intentionally titled this book the design pathway for Earth regeneration because I have become convinced that there is only one way to achieve it. As part of my own process of discernment, I name this bias as my own and take the time in this chapter to explore the possible design space for multiple pathways—even though I don’t believe a plurality exists.

This practice of moving beyond our own limiting beliefs is essential for doing regenerative design at the scales that will be necessary in the coming decades. It is not merely a rhetorical trick, but rather a practice of embracing paradox in order to move through it and carry contradictory insights forward while doing so.

A design pathway is a developmental trajectory—filled with design choices along the way—that moves toward a sequentially derived outcome that cannot be achieved in a single step. This is best explained using an example. When John F. Kennedy declared that the United States should place a man on the moon by the end of the 1960’s, he was advocating for a design pathway to fully enter the space age. A trajectory would be needed that (a) identified all of the necessary steps involved; (b) outlined the obstacles to success for each necessary step; (c) progressed
sequentially (or in parallel) through the resolution of all obstacles as each step was completed; until (d) the final outcome was achieved.

How each of these steps is understood at the beginning of the process may have very little resemblance to what the actual trajectory looks like in hindsight after it has been walked together by all of the people involved. This is because the purpose of a design pathway is to hold intentions for navigating toward a North Star beyond the current horizon of knowledge. We will need to make efforts to comprehend the obstacles and opportunities involved so that we can navigate to the best of our abilities, but this is quite different from what we will learn along the way as we actually walk the path.

Rather than seeking to resolve this paradox, we will need to find ways to embrace and internalize it. I will now begin to share some of the aspects for a design pathway to regenerate the Earth so we can practice walking the path together. We will draw parallels between the design pathway for putting a human on the Moon and the much more complex challenge of restoring planetary health and resilience for humankind.

The North Star for entering the Space Age was to demonstrate that human beings can leave the surface of the Earth, be carried safely through a significant part of interstellar space, arrive on another celestial body to touch it with their own hands, and return intact back to their home planet. This is what was achieved with the Apollo missions when Neil Armstrong declared that he was taking a “giant leap for mankind” while stepping onto the Moon’s surface. He was operating within a worldview of technological progress meant to demonstrate that a Western democracy could create the conditions for sufficient wealth, innovation, and ingenuity to overcome all of the challenges involved in making this happen. The larger political context that this design pathway emerged into was the post World War II era of ascending economic tensions as the previous colonial empires were congealing themselves into a planetary-scale framework of market economy systems.

We will need to consider how Earth regeneration is similarly embedded within a larger political context as we attempt an articulation for what our North Star might be. The Apollo mission was successful in large part because the twenty year period before the 1960’s included a massive wartime investment in industrial manufacturing capabilities that included institutional structures for large-scale project management and the technical training of several million people. There would not have been a man on the Moon without land-grant universities, assembly-line manufacturing facilities, national laboratories, a high corporate tax rate to pool the necessary resources, and a large number of other developmental factors. Advances in science and engineering throughout the prior century were of high importance to the development of radar and electronic communications infrastructure used during times of war that could be adapted to economic competition as political geographies opened up to resource extraction in the post-war period.

I am intentionally painting a picture of constructed social niches—the institutions and cultural capacities of the US population in the 1960’s—together with a human ecology foundation of
resource distributions and mindsets related to how they should be utilized. The attempt to place a man on the Moon was a direct continuation of the previous colonial conquest mindset that was achieving a new scale of coherence at that time as nation-states were organizing themselves around the formation of global governance institutions like the United Nations, International Monetary Fund, and World Bank to orchestrate the emergence of a fully globalized market economy.

We must find our North Star in the aftermath of this period we are now living through. The political structures set in place during the mid 20th Century set in motion a dynamic of market deregulation and wealth hoarding that was largely achieved by dismantling and consuming the infrastructure of centralized governments that had been built up within the New Deal and Bretton Woods frameworks. By the 1980’s there were the first political victories for this “free market” Neoliberalism movement in the successful elections of Ronald Reagan in the United States and Margaret Thatcher in the United Kingdom. A trans-Atlantic partnership to build networks of think tanks, communication and media outlets, and endowed faculty positions at universities had been slowly building capacities for three decades to make this political victory possible.

The stage was set for an end game of resource hoarding. It was in the early 1970’s that the Club of Rome commissioned a report to study the complex interdependencies of a globalized economy as resources were exploited at rates faster than they could be replaced. This “Limits to Growth” study showed what the ecological consequences would be if the exponential growth of material consumption continued along the trajectory it had at the time. This business-as-usual trajectory has been tracked with frightening accuracy for the intervening decades between then and now.

We must find our North Star in a world that has overshot its capacities to support us. The planetary boundaries already crossed—loss of biodiversity, land-system change, cycling of nitrogen and phosphorous, and climate change—are symptomatic of this overshoot condition. How do we best articulate what “success” looks like for Earth regeneration in a context like this? The articulation that has the most endorsements at present is a United Nations process that convened a large number of governmental, civil society, and corporate partners to identify a set of Sustainable Development Goals (SDGs) that can be used to direct future economic development.

The SDG Framework lists 17 goals with 169 targets that must be hit in order to reach all of them. It is a fragmented and internally inconsistent framework that places emphasis on conflicting goals like continued economic growth alongside the “alleviation” of poverty. Ecologists will take pause at this because the growth of consumption patterns in any ecological context will eventually take the consumers beyond their carrying capacity and create the very conditions of scarcity that produce impoverishment. There is no physical way to grow wealth in support of everyone indefinitely into the future while growing the size of the economic system indefinitely into the future.
For this reason alone, the SDGs cannot serve as our North Star. And it is not the only limitation of that framework. How do people gain holistic insights about the key systems involved by breaking them apart into long lists of goals and targets? This constellation approach of breaking the North Star into a large number of small stars—arranged into patterns of relationships—is pedagogically weak because it makes the interconnected systems more difficult to understand rather than bringing conceptual simplicity and clarity to support the learning process.

I have chosen the planetary boundaries framework as the way that I conceptualize the North Star because it has been visualized by the Stockholm Resilience Centre as a donut of concentric circles. The inner circle is the safe operating space for all nine planetary boundaries. Cross this circle by moving outward and you enter the “overshoot” space of increasing disruption to the planetary system. Move far enough and you come to the outer circle of the donut, which is the threshold of severe destabilization that I think of as the place where all hell breaks loose.

This visualization—not the earth sciences it is based on—assumes that all nine planetary boundaries can be measured in isolation. It also assumes that there is a single measurable threshold for each planetary boundary at the line of the inner circle and the line of the outer circle. Earth system scientists are actively debating and clarifying the problems that emerge from these assumptions—and the work of knowledge creation is not finished at this point in time. Yet in spite of these weaknesses, I still hold that we can employ the planetary boundaries as a conceptual narrative to say that our North Star is to get all nine boundary dynamics back within the inner circle. The framework becomes like a target toward which to direct the arrow of our hearts and minds, so that we might strike true at the soul of Earth regeneration.

Thus our design pathway prioritizes the most urgent planetary boundaries—those already crossed and in the danger zone—while holding awareness for the other planetary boundaries to set constraints on our collective actions so that we don’t intensify harms within them while seeking to address the more urgent threats to our survival. If we set the goal of getting back within the planetary boundaries for a safe operating space for humanity, we will need to stabilize biodiversity loss, engage in regenerative land-system change, bring an end to excessive nitrogen and phosphorous cycling, and stabilize the climate system to Holocene-like conditions.

Not a small order! This is a gargantuan task.

Among the obstacles involved are the existing structures of the globalized economy that get in the way of efforts to do this. There are historical patterns of debt accumulation that drive key economic institutions. The concept of stranded assets being one of them—where prior investments were made to seek future financial returns but those future returns diminish in new policy environments to the point that investors choose to abandon them. Existing structural inequalities is another one. We will discuss in a later chapter how prosocial behaviors built on trust, cooperation, generosity, and good faith relationships are essential for regenerating the planet. At the same time, these prosocial tendencies are undermined by scarcity, hoarding behaviors, disenfranchisement, and coercion—all of which have intensified
with increasing structural inequalities throughout the colonial and post-colonial periods of human history.

I began this chapter by saying that we will explore multiple design pathways. So far, I have mentioned two of them. A large number of legacy institutions from the late 20th and early 21st Centuries are organizing themselves around the Sustainable Development Goals with a stated intention to achieve them by 2030. A number of key indicators imply that we are moving away from these targets and that it is unrealistic to believe they are achievable without collapsing the current economic system. This is confounded by the inherent inconsistencies mentioned above between the goals of economic growth and poverty reduction that together reveal a systemic ignorance about ecological reality.

The second design pathway mentioned is to direct our efforts toward the center of the donut for planetary boundaries as articulated by the Stockholm Resilience Centre. This would require that we prioritize the halting of biodiversity loss, regenerating of functional landscapes, reducing the cycling of reactive chemicals, and stabilizing of planetary climate. This has a more cogent feel of holism yet also reveals how complex and overwhelming it can be to do the work of Earth regeneration.

A third design pathway that hasn’t been mentioned yet is what I might call the Sociopath’s Dream—as expressed through the vision of the most successful wealth hoarder on the planet at the time of this writing. Jeff Bezos is the founder of amazon.com and his personal net worth at this moment is $110 billion. He is investing his money in political influence to remove tax structures and open up a developmental pathway for resource extraction from asteroids, colonization of Mars, and interstellar conquest maintained by achieving immortality through the creation of artificial intelligence.

This dream is shared by Elon Musk, Ray Kurzweil, and a handful of other billionaires. They are together orchestrating a plan to upload their minds to computers, create survival bunkers both on Earth and Mars, so that they can wait out the collapse of humanity on our home planet. Presumably they are hoping the Earth will regenerate itself after humans have been eradicated so that they can come back to claim the spoils afterwards.

This is actually their vision. It is potentially a “viable” design pathway for sociopathic people who lack the moral conscience to care about the wellbeing of other humans and non-human life. Disturbingly, it is also the design pathway that globalized humanity is currently walking together as the majority of us live in cities, participate in consumer market economies, and grow the extent of planetary overshoot at an exponential pace that increases with each passing year.

A fourth design pathway could also be articulated—what we might call compost and regrow where the human population overshoots and crashes, which opens up a lot of ecological niches for developmental succession. This is the scenario where the Earth regenerates naturally after the ecological pressures of human population combined with the amount of consumption
expressed per capita is released by the fall of both measures due to a combination of declining population and depletion of available resources for patterns of consumption.

One difficulty for this pathway is that the Earth might go through a jump in trajectories toward what the lead scientists at the Stockholm Resilience Centre call “Hothouse Earth.” This is the scenario of runaway global warming that kills the Earth’s biosphere and, in the remote extreme, takes the Earth toward an atmospheric composition similar to that of Venus. If Earth’s biosphere is killed, we can conclude that humanity went extinct somewhere along the way. Even if this extreme is not reached, the unraveling of ecosystems amidst planetary-scale extinction events could take us down with it even if many millions of species continued to exist.

I share this scenario because it informs how we discern the range of possibilities. Everything from declining ecological pressure—due to a drop in human population combined with lowered per capita consumption of material resources—that achieves a kind of sustainable harmony between humans and the rest of nature and the total annihilation of life on Earth are possibilities for us to consider.

We may have several design pathways to choose from. But I am convinced that only one of them can work in the long run. I reject the Sociopath’s Dream as ethically bankrupt and too risky for triggering a cascade toward Hothouse Earth; and I consider the SDGs to be too fragmented, weak, and internally inconsistent for the scale and urgency of the predicament we are in. I also feel that those of us seeking to avoid human extinction need to take care that the trajectory for a Hothouse Earth be avoided in the coming decades. This might evoke the sense that what I am advocating for is a unified (or centralized) top-down approach to Earth regeneration. It is important to clarify that this is not the case.

Regeneration was described in the previous chapter as the dynamic processes inherent to all living systems that enable them to reproduce the condition of being alive from moment to moment. Any design pathway for Earth regeneration will need to match this description—effectively meaning that the design pathway must be an expression of autopioesis embodied as biomimicry for human economic, political, and social activities.

It might help to think about this in terms of homeostasis where there exist a nested hierarchy of scales that are all functionally interdependent with each other. Regeneration occurs in the human body when individual heart cells are able to functionally interact with blood cells, kidney cells, and more than 200 other kinds of cells through tissue complexes, organs, organ systems, and the body as a whole.

The same will be true for Earth regeneration. Our design pathways must exhibit the properties of self-organization and internal dynamic harmony that is expressed in the aliveness of all living things. Perhaps it is time to clarify what regeneration looks like in human economies to help us begin to envision what a design pathway might look like that enacts models of collaboration that have the potential to be successful.
Let us turn to that now.

**Chapter 6 — Principles for Creating Regenerative Economies**

Have you noticed that mainstream economists don’t seem to understand that we are in planetary collapse? It is as if they live in a narrative bubble that persistently believes human economies to be separate from the natural world. There is a historical reason for this that make sense when we reconstruct the cultural evolutionary process for how the field of economics arose separate from discoveries in the studies of complexity, evolution, and living systems that coalesced after economics established its foundations.

A great schism arose in the 20th Century between the cultural evolution of economics as an institutional endeavor—how it is typically taught in university courses and how it is used to guide policymaking—and the cultural evolution of ecological perspectives about the functioning of healthy communities in the study of living systems. Economics started out as an inquiry into the moral and political aspects of human social behavior, gradually transitioning from the realm of philosophy in the 17th and 18th Centuries into fledgling steps as a scientific field in the late 19th Century.

The writings of people like Adam Smith and David Ricardo have served as an introduction to the philosophical foundations of the field. Secularism was on the rise in the late 1800’s and church sanctions against scientific inquiry into moral aspects of human social life were becoming more relaxed. This enabled economics to incorporate more mathematical insights and to work with principles drawn from other scientific domains. Specifically, economics drew upon the well-established mathematical insights of statistical physics in the field of thermodynamics to create models for how economies function—greatly increasing the rigor and clarity about how to study economic behavior.

In this timeframe, roughly between 1880 and 1930, the field of economics laid its scientific foundations on the statistical patterns of equilibrium physics because it had equations that were relatively straightforward to use. Calculations could be made using pencil and paper to explore patterns of behavior in the economic models. What this means in practical terms is that economics became the mathematical study of dead matter as it constructed “laws of nature” using the tools in physics that were developed for the study non-living energy exchanges like the expansion of a gas in a sealed container or the release of energy during a combustion cycle.

The field of biology was a mess during this period of time. It couldn’t offer reliable insights about how living communities (e.g. populations of animals, plants, fungi... humans) might work as ecosystems. This is because Charles Darwin’s foundational ideas about evolution were heavily contested between the time of publication of *On the Origin of Species* in 1859 and the later creation of reliable statistical accounting tools in the 1920’s to keep track of biological
traits in a consistent manner. These tools of population genetics enabled biologists to clearly track the evolution of biological traits and see how natural selection operates in a community. Biology became fully Darwinian at this time in what has come to be known as the “modern synthesis” that placed natural selection on solid ground.

The outcome of this complicated historical period was that economics established itself as a science by incorporating a set of mathematical models that were fundamentally incorrect. Remember that all living things are dynamic processes that continually reproduce the conditions of, well, being dynamic. The only time a living being might be at equilibrium is just after they die—and even then there are other organisms going about the business of keeping the chemical energies far from equilibrium for themselves as they draw nutrients from decomposition of the recently deceased.

It wasn’t until the invention of digital computers that the field of ecology really took hold in the 1940’s and 50’s. This opened up the pathway for experimental studies using computation to explore the dynamic patterns of living systems. It was part of a much larger revolution in science that previously had to ignore complexity with simplifying assumptions and employ reductionistic approaches to make topics manageable for rigorous inquiry. The tools of digital computing opened up a new domain of investigation that led to the creation of complexity science and a host of new mathematical modeling tools for predator-prey relationships, dynamic interactions between organisms and their environments, and a lot more.

The schism in economics throughout the 20th Century has been the failure to weave these increasingly contradictory perspectives into a coherent framework for the study of economies as living systems. Professional economics has remained “neoclassical” in its core by refusing to let go of the long-ago demonstration that equilibrium assumptions were incorrect. Instead it dedicated itself to the creation of “rational actor” models of economic behavior that have also been heavily criticized as each of their mathematical assumptions gets disproven by discoveries in the cognitive and behavioral sciences.

There has been an explosion of knowledge about ecological economics, the evolutionary patterns inherent to living systems, and the study of emergence in all forms including those for non-living parts of the Universe. Which is to say that the foundations for a regenerative economics are quite solid and can be built upon with rigor—albeit mostly by integrating knowledge from all of these other fields that formalized economics has chosen, rather unscientifically, to ignore.

There is a story to tell about the role of ideological propaganda in keeping economics from becoming a science, that we might explore at another time. For now let us remain focused on the principles of regenerative economics that can guide us in formulating and clarifying the design pathway for Earth regeneration. I will use the framework developed by John Fullerton at the Capital Institute because I find the eight principles he has synthesized from many other people’s work to be particularly clear and practical.
John Fullerton’s articulation for the eight principles of regenerative economics are:

- **In Right Relationship**: Every living being is part of an interconnected web with all other life. Maintaining the capacity to remain as part of a community in the web of life requires every living being to be in right relationship in terms of size, pace, and function so that the web remains harmonious.

- **Views Wealth Holistically**: Wealth should be understood and measured in terms of the overall health and well-being of the whole, achieved through the harmonization of various kinds of capital such as social, living, and experiential. The health of the whole is the source of wealth for the parts.

- **Innovative, Adaptive, Responsive**: In a world that is ever-changing, living economies must be innovative and responsive. The concept of fitness is about having this ability to adapt to changing contexts in intelligent and effective ways.

- **Empowered Participation**: All parts of a living system are empowered to functionally participate in a manner that supports the health of the whole system while also ensuring that the parts are able to maintain health at the same time.

- **Honors Community and Place**: Each human community is a mosaic of peoples, traditions, beliefs, and institutions uniquely shaped by long-term pressures of geography, human history, local environments, and changing human needs—thus the focus on cultivating health and resilience appropriate to living in place.

- **Edge Effect Abundance**: Creativity and innovation flourish synergistically at the edges of systems, where the bonds holding the dominant pattern are weakest. Guide co-evolutionary processes in these “edge spaces” to cultivate adaptive responses to changing conditions.

- **Robust Circulatory Flow**: Just as human health depends on the robust circulation of blood, oxygen, and other nutrients; so do economies depend on robust circulation of money, information, and other resources in order to maintain systemic health.

- **Seeks Balance**: Regenerative systems are always in a delicate dance in search of balance. Achieving it requires that they harmonize many variables instead of optimizing for one. They never achieve equilibrium, yet continual flow toward and around harmonious arrangements.

Notice how nothing is said about “behaving rationally” or that specific mathematical laws are operating to achieve balance in “supply and demand.” This is because regenerative economics is philosophically closer to the study of biology than it is to the study of physics. Philosophers of
science tend to use physics as their reference frame—drawing attention to universal laws and the equations that accompany them.

Biology advances differently in a way that has created a lot of confusion over the years. It doesn’t make progress by discovering universal laws. Nor does it seek to formalize its discoveries in mathematical relationships that conform to the grammatical rules of equation-writing. The science of biology advances by combining the accumulation of carefully gathered field data—to document the stunning diversity of structures, patterns, and behaviors that exist in the world—with increasingly honed and clarified concepts about how to make sense of this data.

Thus biology advances through what are often contentious debates about the meaning of things like fitness, adaptation, species, community, and selection. These are not mere words for the biologist, but rather honed and sophisticated tools for critical inquiry and interpretation that take on highly specialized meanings depending on what part of the living universe is under scrutiny.

We will need to practice the philosophy of biology ourselves as we seek to grow regenerative economic systems. What makes the economy of the Hudson Valley adaptive to its unique place? How can a community in the Serengeti select cultural practices that increase its fitness in this particular biome? Note the focus on interrelationships. No biological concept stands on its own. It is only able to make sense when inquiring about the dynamic interactions between particular living things in particular environmental settings.

Of course, biology also makes heavy use of game theory and agent-based modeling. A huge library could be filled with the computational tools that are used to explore evolutionary strategies and different process models for things like the diffusion of innovation, resource management, policy for allocations, and contextual limits—all of which play major roles in shaping the behavior of ecosystems in the real world.

Great care will be needed to hold dialogue about what we mean by different words as we go about the work of increasing the regenerative aspects of economic systems in the places where we live. This will include how we reflect on the principles outlined above. Let us know begin to think about what the creation of regenerative economies might look like as part of a design pathway to regenerate the Earth.

Think about three of the principles mentioned above—robust circulation, being in right relationship, and honoring community and place. It makes sense that these aspects of systemic health (a fourth principle) are deeply intertwined when we think about living in a small village near a flowing river. There are people who construct homes, grow food, make textiles, and engage in various kinds of exchange with one another. They need to keep track of material flows for whatever they are using to be sure vital inputs are not depleted too quickly. This is what robust circulation means in material terms.
Similarly, if one person owns all of the trees there will not be “right relationships” from which to manage forests and be sure all of the building supplies (or medicines grown from plants) get taken care of to ensure they are sustainably used during difficult times. There need to be harmonious relationships between people and their landscapes—and also between the people themselves. This relates to the teaching of ethical care for honoring community and the landscapes on which their survival depends. A regenerative economy will include ethical training for leaders and strong management skills for how to cooperate and achieve shared goals.

This simple thought exercise shows how intuitive the principles can be. It also helps us see that we can design for the expressions of economics that we want to live within by employing these principles consciously and with strategic intent. It is this capacity for larger emergence of regenerative systems to which we now give our attention.

Chapter 7 — Regeneration at Territorial Scales

All over the world there are permaculture projects, efforts to conserve landscapes, community groups exploring how to transition away from fossil fuels, ecovillages and cohousing projects exploring different ways to structure human relationships with surrounding ecosystems, and indigenous groups of various kinds embodying fragments of their cultural heritages. Together these regenerative projects number in the tens of thousands—with elders dispersed among them who have devoted their lives to regeneration for decades and have much to share about how to take what has been learned before and pass it along to younger generations.

What is generally lacking from these efforts is the capacity for regenerative interventions to achieve coherence at whole-system scales. I have visited regenerative agriculture and reforestation projects on a hundred acres of land, yet continue to see fragmentation and breakdown of ecosystems at larger watershed scales. When we take a moment for deeper reflection it becomes clear that most of what has been achieved so far is too small, too fragmented, and too compartmentalized to become truly regenerative.

This is usually not the fault of the people involved. It is merely a reflection of the larger patterns of private land ownership, economic globalization, exponential population growth, and structural power relationships that are geared toward extraction for short-term profits. A key question has been—and continues to be—how do we “scale” regenerative models so that they are able to become fully self-regenerating?

In my earlier work applying cognitive science to social change efforts, I found it to be essential that people learn how the human mind is an emergent pattern of meaningful actions that arise through bodily processes. Our embodiment is what makes us alive and enables us to have consciousness so that we can engage intelligently as participants in the drama of life. The key
organizing principle being that multicellular bodies are dynamically structured to process information in support of autopioesis at the whole-organism scale.

This insight offers a surprising parallel for regeneration of entire ecosystems.

Your body has trillions of cells in it. All of them need to receive energy and nutrients from moment to moment. Thus there is an orchestration of dazzling complexity to organize the information about how these resources flow that continually keeps your body in the survival range to maintain homeostasis—stabilizing internal temperature, pressure, acidity, circulation, and other key parameters essential for staying alive. The emergent dynamic pattern is that of a body filled with mindfulness throughout. Consciousness is one of the non-reducible capacities that springs forth as the orchestra continues to play out across the entire body throughout its entire lifetime.

After learning how the body creates a mind, it was a natural extension to see that *territorial regeneration* occurs at the level of functional landscapes that have structured ecological flows organized around the physical aspects of rivers and mountains, coastal estuaries and rock substrates. Information is organized so that it flows at landscape scales to achieve the analog of autopoiësis for ecosystems. These functional landscapes are the organizing principles for regeneration to occur at whole-system scales. The orchestra of interdependent life that springs forth within them has network flows and emergent properties similar to the patterns of bodies that have minds flowing through them.

What this tells us in the context of Earth regeneration is that we cannot organize our efforts around topical themes based on human categories alone. There is no such thing as water issues unrelated to biodiversity or prioritizing climate change over election reform. We must instead organize our efforts around the functional landscapes of real-world ecosystems to achieve the emergent capacities of sustainability at territorial scales.

Consider this example that my family is engaging with right now. We recently moved to the village of Barichara in the northern Andes of Colombia where there was historically a tropical dry forest filled with hardy desert plants and ecological corridors for migratory animals. Five hundred years ago this terrain was a patchwork of human settlements for indigenous peoples in the Chibwe language group—who engaged in creating their own baskets and textiles from local materials, foraging and hunting for food from the land, and ongoing trade with one another.

A colonial empire entered the scene with the spread of European diseases and a mindset of enslavement for personal gain. The local peoples were exterminated or died off, joining the unique fossils found in the rocks from an ancient ocean that are scattered throughout the area. What followed was a complex pattern of establishing fincas (farms and plantations on privatized land) of various sizes until about half a century ago when tobacco became a major export crop for the region.
This incentivized a process of severe deforestation throughout the plateau overlooking three major river systems as the tropical dry forest was destroyed, leaving behind exposed clay and dried up streams. The Barichara River running across this plateau historically had about 15 tributaries that carried water through the forest canopy and underground root systems during the dry season that was stored up and continuously cycled from a recurring annual wet season.

There is no way to bring the Barichara River back to life on a single plot of land. Even the most skillful permaculture practitioner on a five acre farm cannot rejuvenate the flow of clean water. Only an effort organized around the entire watershed holds the potential to do this—if it can be done at all. Interestingly, the ancestral pattern of human settlements prior to colonial conquest had self-organized into a network of material flows that remained in relative harmony with the dry forest ecosystem of the region. This is because both had co-evolved for thousands of years until a stable configuration was achieved.

A kind of homeostasis was evident in the land-use patterns, population density, spiritual practices, subsistence lifestyles, and regional trade networks of the humans living in this territory. The tropical dry forest ecosystems maintained high levels of functional integration and biodiversity in harmony with these human impacts. Everything was in right relationship for empowered participation in the continued life of the region. Permaculture at landscape scales was evident in the stability and longevity of ecological complexity that continually sought balance at this scale.

All the principles of regenerative economics were embodied in the tropical dry forest ecosystem as humans engaged in subsistence living as part of the landscape. Both had achieved a linkage of scales from the smallest tributary stream to the largest river system—in this case, Rio Suarez, which runs from south to north until it eventually drains into the Caribbean Sea. The organization of trade networks and material flows was achieved at this landscape scale. And it demonstrated a capacity to persist for long periods of time measured in thousands of years.

If we were to take actions that seek to build a regenerative economy on this same landscape, we would need to reconstruct this ecological and cultural history to discover the scale of human-environment interactions. Functions of intact ecosystems—for both human and non-human ecology—would need to be identified to see which ones are absent in the present arrangement of heavily degraded land that has lost its forest cover, dried out or washed away (depending on the season) its vital top soils, and polluted trickles of dead streams that are parched dry for most of the year.

Sustainability was present before the colonial conquest of this region. It has been absent for the five hundred years between then and and now. The cultural reconstruction of human lifestyles combined with an ecological reconstruction of “filled” niches in the complex dry forest would be necessary to begin a design process that seeks to restore what has been lost. Small-scale projects on disparate parcels of privatized land, where fences and property rights form a patchwork quilt of fragmentation across the landscape, would need to become woven again
using ecological corridors, natural greenways, drainage channels for ancestral streams, and migration patterns of animal species that no longer cycle nutrients as they did in the past.

The territory itself is the scale of organization. Political boundaries need to be redefined so that management of human affairs begins to orchestrate itself in eco-systemic flows. Economic activities need to be valued and evaluated according to restorative functions that serve the self-regenerating dynamics of living systems.

Only then might the land come back to life. No lesser scale of integration will do.

Chapter 8 — Design Frameworks for Holistic Landscape Management

There are many challenges associated with the regeneration of entire ecosystems. And yet there have been successes that demonstrate how it might be done in a consistent manner. Those of us seeking to restore health to the entire planet are going to find ourselves increasingly dedicated to one or a few specific landscapes. So how might we go about setting up design frameworks for managing the complexities involved in these specific contexts?

At the heart of this question is the evolved human ability to engage in active teamwork. None of us could possibly restore the Barichara River and its fifteen tributaries on our own. The same is true for every other degraded landscape on the planet. We are going to need to work well with a diversity of people in our region while also collaborating with a diversity of plants, animals, fungi, and bacteria. In this chapter we will explore some exemplary frameworks and approaches that have enough track records of success to be helpful for feeling into how all of this might be done.

I have been inspired to learn about the work of EcoAgriculture Partners—a nonprofit organization that has worked on large-scale projects to manage the restoration of community health and resilience by holistically managing landscapes. They have numerous reports and case studies on their website that describe how they have supported multi-stakeholder processes to create the conditions for regeneration in numerous cultural settings throughout Africa and Latin America.

The framework they use is called Integrated Landscape Management and it can be sketched as a five step process:

Step 1 — Gather together the key stakeholders in a region who represent important parts of the landscape and its embedded human systems. Convene these stakeholders through the process of co-creating a design pathway for territorial regeneration. This will require some skill at mapping social networks, weaving people and organizations, thinking in terms of systems, and facilitating the patterns of emergence that flow throughout the entire process.
Step 2 — Help this multi-stakeholder group to map the key systems of their territory. They will need to cultivate a shared understanding of historical developments that gave rise to current challenges. They will need to visualize the degradation of ecosystems, while also gathering knowledge about community assets and cultural strengths for their region. This might involve the study of ecosystems using geographic information systems (GIS), demographic research into the political economy of people and the kinds of work they know how to do, and gathering of climate modeling studies to explore future change scenarios.

Step 3 — Construct scenarios of future change for the region to see how different assumptions shape what kinds of futures may be in store for people living in this place. How diverse might the future conditions be when the consequences of different values, practices, and investments are put into play? What kinds of scenarios feel the most realistic? Desirable? Unthinkable and unacceptable? This will reveal a lot about what the stakeholders value today as it is mirrored back to them in their imaginings about the future.

Step 4 — Informed by the process up to this point, co-create an agenda for the design pathway (e.g. future scenario) that best represents the values and interests of people living in this region. Set goals for the short, medium, and long-term. Run the scenario backward in time from 10 or 20 years out to see what steps need to be taken at each earlier stage to increase the likelihood of success.

Step 5 — Set up monitoring systems and accountability protocols for how to guide the agenda through its implementation. Include key “moments” to re-evaluate and update the shared understandings of how things are playing out. Prototype and test different models for landscape restoration, community economic development, measurement of values flowing throughout the system, and finance tools for managing investments.

The basic idea is to treat the entire landscape as a functional whole and cultivate the capacities for collaboration that match systemic health requirements for this level of organization. This is necessarily open-ended and improvisational—while at the same time structured around shared purposes and clearly outlined goals.

Another framework that has proven to be quite powerful is in the work of Michael Quinn Patton and those trained by him. It is called Developmental Evaluation and can be thought of as an adaptive approach to managing complex systems while guiding them toward desired system-level goals using evaluation tools and frameworks. This is quite different from setting up an evaluation for static measures that (a) presume the system is fully known from the start; and (b) that the measures are adequate to guide changes because the system will not fundamentally change throughout the developmental period. Real-world complexity requires us to continually learn how to measure social and ecological change anew, as the systems co-evolve in profoundly dynamic and often surprising ways.
Developmental Evaluation brings the evaluators into the core team as co-creators of the developmental process—working closely with implementors who guide the management of complex programs through evolutionary processes that cannot be known ahead of time. There is a necessary capacity to listen deeply, remain improvisational and adaptive in changing environments, manage conflicts effectively as they arise, and support the stakeholders involved to remain engaged as strategies and goals sometimes change abruptly midway through the process.

Parallels can already be drawn between these two frameworks to see how they might work together. While guiding an integrated approach to holistic landscape management, there is need for dynamic facilitation to navigate disruptions, resolve conflicts, and continuously evaluate the monitoring frameworks associated with purpose, values, and mid-term goals. This is how conservation management practices have come to be successful in the last few decades.

Consider the Gulf of Maine as an example. It is a shallow inlet of ocean water that is home to one of the most productive fisheries in the world. It is also the most rapidly warming part of the world ocean, with measured increases of 5 degrees Celsius since 1980. This amplified warming came about as the Greenland ice sheet began to melt, releasing huge amounts of fresh water into the North Atlantic that flowed westward towards New England and Nova Scotia. This surface current strengthened enough to stop the the downward flow of Arctic waters—resulting in a destabilized and collapsed marine ecosystem. The regional economy collapsed along with it as fisheries went into full decline over the span of a single human generation.

A practitioner trained in developmental evaluation named Glenn Page had previously spent three decades learning how to manage restoration efforts for entire marine ecosystems. He stepped into this role locally—from his home that is based in Portland, Maine—to engage in territorial regeneration for the river systems that run into the Gulf of Maine. Skilled at deep listening, the facilitation of community development, and with lots of experience grappling with real-world complexity, Glenn has played a vital weaving role among the five First Nations Tribes of southern Nova Scotia, representatives from fisheries in both Canada and the United States, and other community leaders who share the mission to create a regenerative economy. The effort continues as this writing takes place and there are ample opportunities for those living in the region to get involved.

A third framework that can support holistic landscape management is the Cycles of Regenerative Engagement created by the Regenerative Communities Network—which is a learning journey that grew out of the Capital Institute’s drafting of the eight principles of regenerative economics described in an earlier chapter. They gathered a collection of 50 case studies in regenerative economics to look for emergent patterns that might inform how to guide the creation of regional economic systems that function like living systems.

What they found is that the patterns of development for regenerative projects follow the Berkana Institute’s Four Stages for Developing Leadership-in-Community that were identified in
the social innovation processes of many projects around the world. The four stages are **Name** (recognize the value of regenerative leaders already acting courageously within the community, often without being acknowledged by other community members); **Connect** (design and facilitate community gatherings to support the exchange of ideas and resources); **Nourish** (support the communities of practice in their learning process by convening the leaders who already devote themselves to the community itself); and **Illuminate** (create maps and case studies of successful social innovations to help the regenerative leaders accelerate their personal growth as change makers).

When combined with regenerative economics, a cycle of engagement can be used to identify regenerative leaders within a territory and provide supports to their learning efforts in the following manner:

**Step 1 — Name the emergent activation and purpose.** Identify regenerative leaders and convene them around territorial goals. Help them tell stories of regeneration within their own collective experiences and bring stories to them from similar efforts in other places.

**Step 2 — Connect regional networks in live and digital communities of practice.** Build a platform for cross-pollination of ideas and inspirational support from one regenerative economy to another. This involves the creation of a digital storytelling platform that aggregates the learnings from a growing network of territorial-scale regenerative efforts. It also includes mapping of vital systems for cultural and ecological change.

**Step 3 — Nourish and support with cycles of engagement.** Help the community practitioners develop regenerative patterns and metrics, offer workshops and gatherings to the network of regenerative economies, and highlight regenerative projects to support their accelerated development.

**Step 4 — Illuminate to build a movement of regenerative economies.** Continually engage in these activities to increase the density of interaction among regenerative economies and cultivate a shared narrative of restoration for planetary health.

**Step 5 — Redefine the economic policy agenda.** Build a story of regenerative economics that conveys what the patterns are for living systems, how to measure and track the flows of value through them, and how to create viable regenerative economies in diverse cultural and ecological settings.

When this framework is brought together with the holistic management of landscapes and developmental evaluation, it begins to have the feel of something truly systemic and transformational. Everyone is learning how to regenerate their own territories while at the same time learning how to regenerate the Earth. None of us knows how to do this yet, and so
we must employ frameworks in a convergent manner that helps us live into the patterns of emergence and embrace them as fully as possible.

It is still true that we are in planetary overshoot-and-collapse. All of this must be done as dominant systems break down, the human population declines, we twilight the use of fossil fuels, and continue to accelerate beyond the safe operating space for humanity into the coming decades.

At the same time, there is meaningful work to be done and a great deal of progress has been made learning how to do it. It is now possible to envision the structured approaches to landscape regeneration that enable regional economies to transition from extractive to regenerative approaches. And it is possible to structure the learning processes from one region to another so that collective learning emerges for moving toward shared planetary goals.

Chapter 9 — Hold the Blue Marble in Your Sight

As difficult as it might be to do regenerative work at territorial scales, consider what will happen as millions more people become climate refugees when wars break out over scarce resources, prolonged droughts cause disruptions to food supplies, and as floods and wildfires displace people. This is already happening at an intensifying pace.

The collapse of the Sahel Monsoon described in the preface took place in Sub-Saharan Africa in the 1960’s. World hunger became a standard concern in the 1980’s—just one generation after the use of fossil fuels had enabled industrial agriculture to explode the human population by two billion people. In the last decade there was a prolonged drought in Syria that culminated in militarization and radicalization of religion, a cascade of territorial conflicts, and the displacement of several million refugees.

We are already acclimatizing ourselves to wildfires that burn down entire communities in California, wealth hoarding of such a scale that legacy empires like the United States and Britain are crumbling from propaganda-fueled corruption, satellite images of entire continents like Australia burning in unison, and the complete failure of globalized institutions to even create enforceable treaties let alone actually do something about our predicament.

In other words, the regional economies that increase their internal resilience through regenerative design will need to contend with collapsing resilience in neighboring regions and from across the planet. There is no such thing as territorial regeneration in the absence of planetary regeneration.

This is where we return to the Planetary Boundaries framework described in Chapter 2. There is a visual target of getting all nine Earth System processes back within the innermost circle—
ensuring that none has been crossed and all are mutually stabilizing as a kind of functional homeostasis for the Earth.

Each territorial regeneration effort will need to develop in harmony with a growing network of other territorial-scale efforts. Only when an as-yet-unmeasured critical threshold is reached for how much of the Earth’s surface is covered by regenerative human cultures will a process of planetary healing be said to have begun. We will need to apply the Developmental Evaluation framework to the entire planet across the network of regenerative economies as they each attempt to take hold—and all together seek to learn from each other about how best to proceed.

Michael Quinn Patton and Glenn Page have already outlined this approach. They call it *Blue Marble Evaluation* and have a book by this name that has just come out in September of 2019. The core idea is to create dynamic frameworks for evaluation to guide economic development—while always holding awareness for the linkages from local-to-planetary so that regeneration can be tracked across all relevant scales in a synchronous fashion.

Imagine what it might be like to engage in regenerative farming practices that increase the health of soils, capture increasing amounts of carbon, and rescue the outflow of reactive nitrogen and phosphorous into waterways. The local effort is benefiting the Planetary Boundaries associated with climate change, land-system change, and geochemical cycles. Yet there is no evaluation framework in place right now that is measuring how these local contributions sum up for the planetary processes that are involved.

This is the work of Blue Marble.

In very practical terms, these measurements of local improvement create value that needs to be recognized in the economy itself. By creating tracking systems for ecological metrics like these it becomes possible to build investment platforms that track value-creation in such a way that these improvements can be incentivized, de-risked, and resourced financially to help the regenerative economies grow. An example might be the use of carbon credits to increase the valuation of investment portfolios for regional economic development.

People have been creating measurement and finance tools like these for more than three decades now. Many of them have been tested and improved over the years. Yet in the absence of globally-binding agreements among the failed states of the world—which at present is pretty much all nations and the majority of international corporations—there is no system for allocations that consistently accounts for local-to-regional-to-planetary.

Those of us working to regenerate soils and forests in our territories are going to need others working to create these reporting and accounting systems, financial instruments, policy mechanisms, and planetary environmental monitoring capabilities across all levels of implementation. Thus the need to keep the Blue Marble in sight at all times.
You might have your fingers deep in the dirt and your eyes fixed on growing plant roots in the top few inches of soils. Even then, you will need to hold awareness for the entire planet and let this Gaia Consciousness shape your concrete actions toward shared intentions of the entire Earth.

What the Blue Marble does is create a mental connection between the stories we live out daily in our local environments and the Epic Story of Planetary Change that accumulates as these local stories influence planetary processes. We are going to need this awareness built into the ways we perceive, think, feel, and act upon the world around us so that we can direct our collective journey towards a design pathway of Earth regeneration.

Chapter 10 — Let’s Talk About Prosocial Behavior

How can humanity minimize our chances of going extinct as we struggle to manage planetary collapse? There are two major aspects of what needs to be “managed” in this context and both warrant careful consideration. The first is what we have talked about so far—which is how networks of people might collaborate around regenerative design practices to restore health and resilience to landscapes locally and for the entire planet, all done through coordinated efforts. A great deal of trust, generosity, cooperation and good will towards others will be central to doing this at all necessary scales.

The second major aspect for how to “manage” planetary collapse is more internal and psychological. How do we handle being overwhelmed? Feelings of grief and trauma? Increasing polarities of us-versus-them feelings and actions in the world around us? Learning to manage things that are beyond our control is just as important to the cultivation of trust, generosity, cooperation, and good will toward others. In both aspects, it is evident that improvements in our cooperative abilities are needed.

We need to design for prosocial behaviors if we want to regenerate the Earth.

Prosocial behaviors are the sentiments and feelings, judgments and actions, and emergent social capacities for working together toward common goals. They are part of the versatile repertoire of social behaviors that humans evolved with over the last few million years that increase our prospects for survival today. Books you can read about this evolutionary history include Does Altruism Exist? by David Sloan Wilson and UltraSociety by Peter Turchin, just to name two that relate to the topics explored here.

I will focus the discussion on a specific framework that combines insights from the evolution of prosociality in humans with tools developed therapeutically in the field of contextual behavioral science to improve individual and group decision-making when dealing with complex challenges. The framework is called Prosocial and it weaves together the political economy work of Elinor Ostrom who showed what the design criteria are for effectively managing
common-pooled assets—things like shared pastureland, waterways, and forests—with these evolutionary and behavioral foundations.

The first key insight is that every group is a common-pooled asset. This includes the group of cells that make up your body. It includes every ecosystem in a watershed. It includes every team you’ve ever been a part of. When thought of in this way it becomes necessary to manage the commons effectively. This is where Ostrom’s design principles come into play. They are shared here in the manner presented in the book ProSocial: Using Evolutionary Science to Build Productive, Equitable, and Collaborative Groups by Paul Atkins, David Sloan Wilson, and Steven Hayes.

Core Design Principle #1 :: Shared Identity and Purpose
Every group needs to (a) know that it is a group; (b) have the ability to distinguish who is a member of the group; (c) have a shared sense of purpose for what the group is about; and (d) direct its actions toward the preservation of identity and achievement of purpose for the group.

Core Design Principle #2 :: Equitable Distribution of Contributions and Benefits
Every member of the group is able to benefit from the commons that it represents. They have access to these benefits in a manner that is perceived to be equitable and fair to all members of the group. If some members do more to help the group, they should feel like their contributions are reflected in the access to benefits that they receive.

Core Design Principle #3 :: Fair and Inclusive Decision-Making
Members of the group do not feel coerced by the ways that decisions get made. They have the ability to set up decision-making protocols, review and alter them on a regular basis, and generally feel that decisions are made in a fair and inclusive manner with respect to all members of the group.

Core Design Principle #4 :: Monitoring Behavior
The prosocial behaviors that improve group functioning are visibly recognizable and adequately encouraged by the behaviors of other members of the group. Unhelpful behaviors are effectively redirected towards replacements that support group health and wellbeing.

Core Design Principle #5 :: Graduated Responding to Helpful and Unhelpful Behavior
A system is put in place by members of the group to sanction desirable behaviors and redirect unhelpful behaviors in a graduated fashion. This means there are small consequences for infrequent and low-impact behaviors and larger consequences for chronic and high-impact behaviors.

Core Design Principle #6 :: Fast and Fair Conflict Resolution
When conflicts arise, as they do for any group, there are procedures for conflict resolution that address the problem in a responsive and fair manner. All of those involved in the conflict should feel that they are being treated fairly even if some participants are not happy with the outcome.
Core Design Principle #7 :: Authority to Self-Govern
The group has the ability to set courses of action in service to the shared purpose of its members and make appropriate decisions that effect the group as a whole. Other groups do not have power-over (though they may have arrangements of power-with) the group in such a manner that self-governance is inhibited.

Core Design Principle #8 :: Collaborative Relations with Other Groups
The same principles outlined above apply with other groups that the group may choose to interact with. This establishes a “multi-scale” network of relationships were all commons involved in their interactions are honored and included in whatever manner is appropriate to their functioning as groups.

When these design principles are evident in a group, it will be able to function well as a collaborative entity. If you have ever been in a group that had chronic problems, these design principles can be used diagnostically to discover weaknesses or absent feedback mechanisms that would likely improve the efficacy of that group. The ProSocial framework draws upon the tools of what is known as Acceptance and Commitment Therapy to help group members learn how to participate in psychologically mature and healthy ways that support how the group works overall.

There is a great deal of nuance involved in the cultivation of emotional and behavioral capacities for group members—that gets explored in depth with the ProSocial book mentioned above and can be learned via workshops and trainings with experienced facilitators. For our purposes here, it is sufficient to know that tools and frameworks like this exist that can be used as regenerative design elements in the coordination and cultivation of social capacities that get directed toward Earth regeneration.

Let us briefly look at two psychological capacities that have been shown to effect social outcomes when people interact with each other. They are emotion regulation and psychological flexibility. Emotion regulation is the ability to feel an emotion coming on and mindfully pause to recognize it for what it is so that actions can be taken consciously instead of by impulse. If you feel mad and want to hit someone, it really helps to be able to pause and say to yourself “No, I’m just angry. There are better ways to deal with this situation.”

Psychological flexibility is the capacity to explore and empathize with different perspectives about a shared experience. When you realize that you are angry, it is very helpful to be able to consider multiple choices for how you might handle your emotions. Similarly, if you are feeling an impulse to do something now that will make things more difficult in the future, it is very helpful to think about your future self and select alternative actions now that align with future goals and the values you have in relation to them.

These abilities are the bedrock of healthy relationships, academic success, becoming a better person, and a whole lot more. When correlated with a huge list of social ills—domestic
violence, dropping out of school, drug addiction, inability to keep a job, etc.—these psychological capacities are powerful predictors of how well a person is able to live out their life over extended periods of time.

The tools of Acceptance and Commitment Therapy that work within the ProSocial framework are field-tested and demonstrated to increase emotion regulation and psychological flexibility for members of a group. This is vital when difficult compromises need to be made and when those inevitable conflicts arise. As we seek to build the collaborative relationships for territory (and planetary) scale regeneration, we are going to need the tools for doing this in the groups we work with.

Of course, there are many other tools and frameworks that help build prosocial capacities in groups of people. I just happen to know ProSocial well because I have worked with the team that created it and was really impressed by the depth of knowledge about the various parts of how it works. We will collectively need to employ any and all frameworks that increase emotion regulation, enhance psychological flexibility, and cultivate functioning groups of people and institutions in service to Earth Regeneration.

One big obstacle is our ability to face the pain of what must be done. Let us now move into that discussion.

Chapter 11 — Dealing with Grief and Trauma

The most important regenerative work may well be inside of ourselves. Everyone alive today has experienced some kind of trauma. All who see and understand even a glimpse of planetary collapse will live with grief. We love the world and are living scars within it. Yet as wounds of the Earth, we feel into her healing while also experiencing her pain. Grief and trauma have kept so many of us from doing what must be done—and it is grief and trauma that must be lived through and channeled for us to be able to feel new growth where death once was.

Think about this scientifically legitimate statement: *Humans have the ability to feel pain on behalf of the Earth.* When James Lovelock and Lynn Margulis outlined the “Gaia Theory” claiming that the biosphere of Earth gradually became a co-evolving system to maintain the conditions conducive to life, there were a lot of scientists who were queasy with the use of mythical language to name the planet as a female deity. Thus the scientists chose a more credible-sounding label—they called it Earth System Science—when they basically concluded that the theory was correct.

We are descendants of the six million year old hominin line, embedded within the larger web of mammalian evolution that goes back 210 million years, which is ultimately part of a continuous flow of life going back 3.8 billion years. Humans are nature. We are Gaia. Just like everything else that has ever lived and every species alive today. So when we humans feel grief and
trauma at the destruction of landscapes, collapse of ecosystems, and extinction of species, we are Gaia feeling grief and trauma as one part of the life system of the Earth for another.

I am taking care to intentionally place humans within the biosphere so that we can see how important it is that the Earth cultivated the ability to feel grief, sorrow, pain and loss for the love of life within itself. We must learn how to feel these energies as part of the natural regenerative endowment of our home planet if we are to become stewards and nurturers of life-in-service-to-life at planetary scales.

One of our great challenges—so eloquently described in years of writings and public talks by the elder Joanna Macy—is the need to feel into narratives for what it means to be human in the midst of planetary collapse. We need to believe we are wholesome, despite a mountain of evidence telling us that our species is the most destructive thing around. Earlier in this book I mentioned the importance of ethical discernment in the context of sustainable versus non-sustainable cultures. Here I draw attention to the nuance that we have the ability to create our ethical functions as part of the Earth.

It is not simply the case that humans are bad when measured on the scales of justice. We are still in process, still evolving as a species in the parallel realms of culture and biology. The stage is set for our demise—and almost all species do go extinct when measured on geologic timescales. But our part in the Grand Play of Life may not be finished yet. Imagine what our descendants might express in their gratitude that those of us living through this particular evolutionary bottleneck (when a large portion of the population doesn’t pass on genes to future generations) make the intentional choice to be regenerative designers.

We have a responsibility to act on our feelings. It is not enough to “know” that science has accumulated all the facts about our immature, life-destroying behaviors in the dominant cultural systems on Earth. We need to feel sadness, express grief, weep for the losses at our feet, and from this place of deep feeling open up the pathway to regenerating the Earth.

Trauma is real. Pain tells us that we are alive. Sadness reminds us that we still have the capacity to love. And this is all regenerative.

Remember that regeneration is the collection of processes and feedbacks that enable any living thing to continue being alive. Without these feelings—and the moral judgments provoked by them—no human among us would be capable of doing the hard work involved in stripping away cultural baggage that no longer serves life in order to participate in the regeneration of our only true mother, the Earth.

We will need to create support systems for our grief.

I had the honor of meeting a woman named Donna who attended one of my workshops on planetary collapse in 2019. She has developed herself into a professional grief support worker. When her husband became terminally ill several years before we met, she took on the role of
caregiver for the end of his life. She discovered ways to seek help from her friends, honor the pain inside as an expression of her love, and even in the moments when she felt the grief was too much to bear she discovered reservoirs within herself that she scarcely knew existed.

In the town of Langley, Washington there have been grieving circles hosted by a husband and wife pair for more than twenty years. When a community member became sick or entered the dying process, there would gather a circle of friends who sing and chant, offer blessings and prayers, and hold space for social expressions of grief. This proved so powerful that when the man who started offering them together with his wife became ill and entered hospice, the entire community came together with an outpouring of love that held deep healing power.

How can we bring rivers back to life and restore health to dead forests? What will it take to love a desert for long enough that its soils re-emerge through guided permaculture practices? How much do we need to hold circles of support for each other in the midst of societal breakdowns and the crossing of tipping points throughout the rest of our lives? All of this is regenerative practice—and it is vital that we put supports in place before crises hit so they can hold us throughout their duration.

I would like to give you an opportunity to practice right now. Take a deep breath and calm yourself. Listen to what I am about to say and feel into what kinds of social support you wish you had—as a way to prepare yourself for the design of these supports in the future if they don’t already exist for you. Have you taken that breath yet? Get ready... here we go.

It is too late to save the Amazon Rainforest. A vast web of interconnections have been necessary to keep the hydrological pump of this huge territory—passing through nine countries including Brazil, Colombia, Ecuador, Venezuela, and Peru—and these processes have been broken down to the point of imminent collapse. The combination of land area cleared by deforestation and patchwork fragmentation that severed functional corridors across the Amazon together will be the death blow of this mighty river and the huge carbon storage it historically held. As of right now, as I write these words to the page, the Amazon is “tipping” from carbon storehouse to carbon emitter.

There is nothing that can be done to stop it. The Amazon as we know it is gone, possibly forever. Now add that in the last ten years more than 60% of the world’s barrier reefs have gone away—with the greatest of them all, the Great Barrier Reef, dissolving into the ocean in near-total collapse. These two icons of Earth’s vitality are ended. Humans did the work of making this happen. And we must live with the consequences.

Okay, how do you feel? It might be a good idea to take another deep breath.

The grief is real. It is all around us. And we must build up the body-based practices to deal with it. I first learned how to do some of this when I was a child and my mother wisely enrolled me in Goju Ryu karate classes. That is where I began the physical training to manage my anger and direct my emotional energies toward goals I cared about. Only later did I discover the power of
meditation and contemplative practices, yoga and deep stretching, sitting in silence at a place that is sacred to me for quiet reflection, and a host of other skills that were required for me to hold the grief I manage on a daily basis today.

Grief is physical. It is in our bodies. We feel it because we are alive. Thus we need to train our bodies like athletes and performance artists to channel and direct the feelings of pain so they can flow through us Aikido-style and transform our enemies into friends. We are going to need the grief equivalents of sparring partners and rehearsal stages in which to develop these abilities. Because we are in planetary collapse right now and will need our emotions to be healthy and functioning if they are to serve life and buffer against escalating violence in the decades to come.

Also, our ability to perceive damage inflicted (or neglected) onto the Earth is the same capacity to feel regeneration as it occurs. Your body is an instrument of Gaia. Learn how to play it well and you can make beautiful music with the orchestra of life of which you are merely a part. Let it become out of tune when jolted by forces outside of yourself and you will lose the ability to play.

Gaia calls forth a symphony of regenerative cultures. We each have training to do. There is no way around it, only through it will suffice.

Chapter 12 — A Network of Regenerative Bioregions

The best medicine for grief and trauma is to practice the healing arts for something that you love. We are now in the middle of this book-long learning journey and might want to assess how to weave the parts introduced so far. For this healing of Earth is the balm for ourselves too.

We need to believe it is possible to regenerate the entire planet. And that will take a vision both ambitious and grand enough to feel adequate in scale; while also being concrete and grounded enough that it feels like it could actually work. I have been making an effort to put the scaffolding in place through the previous eleven chapters so that this vision might now be articulated.

So far, we have set out the following design pieces:

1. Identify the root causes by focusing on the runaway dynamic of human cultural evolution as it relates to degradation of landscapes.
2. Practice ethical and analytic discernment to clarify how important the functional adaptations of cultures will be for the regeneration of landscapes.
3. Outline how regenerative design is about co-creating with the dynamic processes of living systems at all relevant scales.
4. Explain what a design pathway is for evolving entire cultural systems toward the appropriate North Star in the future.
5. Name the key principles of regenerative economics to map this approach to entire economic systems.
6. Introduce the frameworks for holistic landscape management that specifies the steps involved in regeneration at territorial scales.
7. Hold onto the importance of linking landscapes as whole-systems for regenerative design with planetary-scale dynamics that must converge into synchronous development for the entire Blue Marble.
8. Name the vital role of collaboration and identify frameworks for increasing prosocial behaviors.
9. Express how grief and trauma are driving aspects of the human predicament. They either create barriers for cultural transformation or open up pathways of healing for self and environment.

With all of these pieces to work with, we can begin to see the outlines for what a holistic approach to Earth regeneration might entail. It is all about the intentional design of social niches that scaffold the formation of regenerative economies. These regenerative economies are structured around functional landscapes like watersheds, mountain ranges, and coastal estuaries. The landscapes are managed holistically with regenerative designs that link the ecological dimensions of local environments to planetary boundaries that must be honored to safeguard humanity’s future.

All of this is guided by prosocial communities of people who cultivate the psychological capacities to work in functioning teams. They increase their levels of trust, cooperation, generosity, and altruism through the enactment of regenerative economic principles in conjunction with landscape restoration efforts. Developmental evaluation frameworks are set up to measure and co-evolve with key social and ecological factors that enable these regional economies to work while also moving toward the North Star of planetary health as measured by the Planetary Boundaries or other related frameworks.

The design pathway is beginning to present itself. I feel that I can now describe it in more detail by drawing upon these elements in a coherent way. Let me first attempt this by presenting it as a story—because human minds have the easiest time making sense of the world when taken on a mental journey with a good story.

In the early 21st Century, globalized humanity had organized itself around extractive economic systems that degraded landscapes and overshot the Earth’s carrying capacity. A legion of regenerative designers came forth to embrace the grief and trauma this caused and transform themselves into cultural seeds for the birth of regenerative economies. In the 2020’s these people began to weave a tapestry of regional-scale efforts to embody regenerative principles and restore vital functions to landscapes.
They organized themselves as regenerative bioregions—the self-organized scale of whole “life systems” for humans to harmonize with their landscapes—beginning as a meshwork of permaculture projects, regenerative farms, ecovillages, partially intact indigenous communities, and other seedlings of the new paradigm that numbered in the tens of thousands but were too fragmented to achieve coherence at territorial scales.

These bioregions “relocalized” their economies and began an active process of monitoring ecological change for their landscapes and inputting their learnings into a planetary framework of Earth Regeneration. As the old extractive paradigm continued its collapse into self-termination, many resources became compost to feed the soils of this bioregional movement. By the 2050’s there was a recognizable network of bioregional economies all working to achieve regenerative autonomy for their own territories while guiding vital Earth Systems back within key planetary boundaries.

The first planetary boundary to be restored was measured and celebrated in 2070—even as the human population continued to plummet and globalized trade networks had long ago become too brittle to survive the onslaught of disruptions that arrived mid-century. Regenerative cultures became recognized as “oasis economies” for those seeking to place themselves in service to future generations. It was looking likely that by 2100 they would be the standard approach for all economic development as humanity continued to survive on a gradually healing planet.

The key insight for this story is the recognition that all sustainable human cultures in the past were organized as bioregions. A bioregion is the ecological scale for an entire life system of an organism. There are bioregions for coral reefs in the ocean; rainforests in the tropics; and so on. When applied to humans, a bioregion is the intersection of key ecological functions of landscapes (think of a watershed, for example) with a shared cultural identity of people who all know how to live in their particular environments.

A famous bioregion is the Cascadia Bioregion located along the Cascade Mountains of Oregon, Washington, and British Columbia. It is a territory that has had human cultures living within it for more than 14,000 years. These people organized themselves around salmon runs in the rivers connecting mountain to sea and as extensive trade networks of coastal villages accessible by boat. The cultural history of this region can be seen in the branching tongues of language families among tribes of people who interacted via trade, intermarriage, and other activities.

When we recognize that subsistence systems of human tribal networks were all organized as bioregions, it becomes clear that this is the appropriate scale for regenerative cultures. Extend this to the planetary level and the only viable pathway to Earth regeneration is to replace all existing economies that are not set up this way with regenerative economies that organize themselves as bioregional networks.
This is the design pathway we must take if we want to safeguard humanity’s future. But we have to contend with some serious challenges—not least of which is the predictable outcomes when resources become scarce and a population is placing too much pressure on its environment. We need to find a way to enact this design pathway while planetary collapse finishes running its course.

Chapter 13 — The Recipe for Fundamentalist Wars

We just laid out what feels like a viable pathway for regenerating the Earth. But is it really viable? It is interesting to observe that Donella Meadows—a lead author of the famous Limits to Growth study and pioneer of systems thinking—wrote a prescient essay in 1983 with the generic title “History of the Ideas Underlying the Balaton Group” that made the same case I just did for setting up bioregional economies that embody the principles of living systems.

Here we are in 2020 (more than three decades later) and almost no one is aware that this may well be the ONLY viable path to planetary sustainability. What has been observed between then and now is an exponential lift-off for every consumption trend you can imagine. Our species has supercharged (and supersized) everything it can think of to speed us as far into planetary overshoot as our fossil fuel reserves allow—all in service to wealth hoarding and greed that has become celebrated in the normative mythologies of Neoliberal Capitalism and market fundamentalism in today’s global exchange networks.

This expression of fundamentalism is not alone. We have also seen the spread of nationalism, xenophobia, new kinds of structural inequality, and militant fundamentalist religions. There is a growing list of “strong man” leaders in the waning empires of the world—the US, UK, and Brazil being most notable at the present moment. If a memo was written about how to avoid extinction all those years ago, it doesn’t seem like global humanity got the message.

I was struck when reading E.O. Wilson’s classic book Sociobiology that the first example he gave for the applications of biological insights to social phenomena was a challenge to the presumption that baboons have a fixed animal nature when it comes to aggressive, hierarchical, and dominance-oriented behaviors. He simply walked the reader through the pattern of interaction for baboons with each other as you change the variable of population density. When there aren’t very many baboons in a particular environment, they have a relative abundance of food and territory to make use of. But if a critical threshold is crossed, things change dramatically—all of a sudden you begin to see intensifying male-on-male competition for the best places to rest, sources of food, and access to reproductively available females.

It isn’t baboon nature to be violent and dominance-oriented. Or rather, it is more accurate to say that this fits within their flexible repertoire of behaviors for changing environments. They might be violent and aggressive in conditions of high population pressure and scarce resources. Yet if the conditions become more favorable for cooperation—as occurred when primatologist
Robert Sapolsky was studying a group of baboons where all of the alpha males got into some poisoned food and died off—you will observe a “phase transition” from one social dynamic to another. In the situation Sapolsky carefully observed, the beta males (those who were lower on the dominance hierarchy before the alphas died out) were much more nurturing and cooperative. The culture shifted into a much more egalitarian mode that persisted for many generations afterward.

How does this relate to the rise of fundamentalism? It’s a more complicated story to talk about humans when there is high population density. We are what some cultural evolution researchers call ultra social in the ways we openly trust and cooperate with complete strangers. This routinely happens when you visit a grocery store and buy food that you trust will be safe to eat. It doesn’t matter that you’ve never met the farmer, have no real familiarity with the cashier, probably aren’t even thinking of the truck driver making deliveries to the store, and so forth.

We have achieved such high population densities because we are so cooperative. And yet there is a way to measure the same kind of phase transition in human populations that was observed with the baboons. In our case, it isn’t simply how many humans reside within the same area of land. Our behavioral flexibility is so vast that we routinely find solutions to this problem, like creating high-rise apartment buildings and supply chains for the transport of goods from remote places. The critical measure for us is psychological. It has to do with how much we perceive there to be chronic, anxiety-inducing threats to our existence.

A groundbreaking study was conducted by a team of researchers using the Human Relations Area Files—a giant database of cultural anthropology and archaeology studies that include geographic referencing to specific types of landscape. The question they asked was whether the frequency of extreme weather, natural disasters, and intergroup conflict—lumped together as a measure of chronic existential anxiety—was predictive for the emergence of fundamentalist religions, military dictatorships, and the systematic dehumanization of those who are not members of their cultural group.

The answer: yes, it is a very good predictor.

What this means for us is that any situation where there is (a) high volatility in weather systems creating droughts, floods, and storms; (b) routine occurrence of disasters like wildfires, earthquakes, and landslides; or (c) increasing and sustained hostilities between human groups as they compete for scarce or depleting resources; will be an ideal incubator for fundamentalist religions, fundamentalist politics, fundamentalist militaries, and fundamentalist economies.

So what is the headline news topic that guarantees these exact conditions for the foreseeable future? It is climate change. When you add the current distribution of wealth, property, and power that has created a context where half a dozen men (it is always men) who control more than half of the private wealth in our globalized economy, you will see that we have a perfect storm for the collapse of prosociality exactly when we need it most.
Remember when I wrote about design pathways earlier in this book and chose to include *The Sociopaths Dream* as one of our possible trajectories? Well we are on that path right now. Those of us who want to create a planetary configuration of human cultures that preserve holistic health for the Earth—while enabling us to continue existing among the millions of other species that evolved alongside us—will need to create regenerative economies that somehow buffer against this larger tsunami of global change.

We should anticipate—even predict—the continuation of narcissistic leaders being elected to high office. The use of nation states to divide us along xenophobic lines will only become more effective. Those seeking the comfort of authoritarian rulers will feel more at home with punisher gods from a separate spiritual realm in whom they can place their trust as the world collapses around them. And these people will be largely incapable of participating in the regeneration of the Earth. They have holy wars to fight and enemies to vanquish. They don’t have time to raise children in deep contact with nature; to cultivate soils and regrow forests on multi-decade timescales; or to build the social depths of relationship necessary to create regenerative local economies.

The scary truth is that they are much more likely to burn our forests with poisons (remember Agent Orange in the Vietnam War—later renamed Roundup Weed Killer?), shoot our families in our homes (how many times have militant governments justified the extermination of terrorists and cults?), and steal our crops so they can feed their professional soldiers and mercenaries for hire (military strategists call this the capture of strategic reserves). And we are going to have to contend with them somehow if we want humanity intact on the other side of this collapse.

**Chapter 14 — The Elixir for Our Protection**

You might be a little overwhelmed by what I just shared in the previous chapter. Even if we do somehow manage to create bioregional economies that heal landscapes and regenerate the ecosystems that once flourished on them in the past, how do we keep the end game of wealth hoarding and extraction from destroying all our best efforts? This is the topic we turn to now.

In the long history of life on Earth, there has been a pattern that only emerged a handful of times over the span of 3.8 billion years. This pattern is the source of our salvation—if we are to find salvation at all. This preciously rare pattern goes by the name of *evolutionary transitions* and it is how all of life’s great complexities have emerged across the giant span of geologic timescales. Examples include the appearance of the first self-replicating chemical interactions; the first self-building and self-repairing transcription system (RNA and later DNA); the first living organism able to reproduce itself; the first multicellular organism that replicates all of its different cell types; and a handful of others including one that is crucial for human survival in this delicate transition.
What do evolutionary transitions have to do with protecting ourselves against invasion by militaristic fundamentalists? The way they work is that prior to the evolutionary transition there were separate functional entities that lived and died on their own. They might have been in mutually beneficial relationships with a partner chemical (or life form) doing the symbiotic dance of collaboration, but the patterns of evolution played out in slightly different ways for each entity.

An example of this is mitochondria—the energy-maker of every cell in the body of every living multicellular organism on Earth—which, thanks to the pioneering work of biologist Lynn Margulis, we now know to be an ancient bacteria that was eaten (but not digested) by another much larger bacteria. The two single-celled organisms were functionally separate yet provided such important benefits to each other that they each became the niche in which the other thrived. Over time, this “my body is your niche — your waste products enable my body to survive” relationship evolved into a functionally completed evolutionary transition. This happened when the mitochondria lost the ability to survive outside the body of its host and the larger bacteria lost the ability to create its own energy supplies and would quickly die if the mitochondria were to leave.

The definition of an evolutionary transition, simplified here to hone in on what is most important for us as Earth regenerators, is that a functional integration occurs such that the previously separate entities are no longer able to survive on their own. What started out as cooperation evolved into deep structural collaboration. And then the transition occurred and it was now trapped forever in a pattern of ceaseless co-creation—one could not be created (biologically reproduced) without also helping to create the other.

Here is the magic elixir that can save us from being destroyed by another human group. We must consciously and intentionally guide our separate social groups through an evolutionary transition. I cannot live without you. And you depend upon me for your survival. This is the principle of regenerative economics described before as empowered participation, except with the additional condition that the absence of participation leads to dissipation, breakdown, parasitism, hostile takeover, and ultimately death.

Applied to the design pathway of bioregional economies, this powerful evolutionary process can build bridges of mutual integration from one bioregion to the next. If you find your life system in the tropical rainforests of Central America, it is vital that you remain vigilantly aware that the ecosystems you depend upon for your survival are only protected when the weather patterns stabilized around the tropical dry forests of the floodplain nearby are able to do their part. Similarly, if you move from one bioregion to another it is important to actively maintain relationships with friends and loved ones there. Send your children to learning centers in another bioregion—where they might grow up, settle down, even get married and have kids—so that your life system is intertwined with theirs.

We need to think of these functional interdependencies early on in the effort to regenerate the Earth because the avalanche of fundamentalism is already upon us and will only crash down
with greater force in the decades to come. The sooner we can establish community resilience in any one bioregion, the better it will be buffered by the existence of its own stability. Yet it will be vulnerable on its own. Just as the planetary-scale of climate change and related Earth System boundaries can inundate us from a distance, so too can the planetary-scale instabilities of powerful cultural groups be mobilized to threaten our regenerative endeavors.

And so we must prepare this special elixir now. Begin to cross-pollinate and spread seeds from each bioregion to many others. Cultivate interdependencies with neighboring bioregions—as well as those with similar environmental contexts on remote parts of the planet—so that the elixir can slowly brew and begin to congeal for when healing may be needed at a later date. This subtlety could easily be lost if we only focused on regeneration in our own back yards. We need evolutionary transitions across (and within) the regenerative economies we seek to grow as we move in the direction of planetary health after the population crash subsides.

Why do I think this can be done? Because one of the historic evolutionary transitions in the grand epic of life has already been described earlier in this book—when *humans form a team* it passes through a cultural transition that meets our criteria. Consider what happens when an All-Star team of basketball players is brought together for a special tournament. Each player has awesome skills that stand out in their unique capacities. But if the core design criteria described in the chapter about prosociality are not met, the collection of individuals will not *function* as a team.

This is why there are famous upsets when a team of less talented players defeat a team of All-Stars because they work better together and coordinate their efforts around shared identity and purpose. The creation of a functional team *is* an evolutionary transition. And it is a very powerful one at that! What we need to learn how to do is create teams; then teams of teams; then organizational support structures for networks of teams of teams. If this can be done across all necessary scales for a bioregion, then the bioregion will begin to function as a *superorganism*—essentially achieving the ability to evolve as a coherent entity.

From here it is the challenge of weaving superorganism with superorganism through cross-regional partnerships and deep cultural interdependencies. Economic trade is one example. Regenerative tourism might be another. Cross-cultural education and distance learning programs may prove to be exceedingly powerful in this regard as well. Is this starting to feel like it might be possible? I hope so.

Elixirs are an ancient form of medicine. They must be carefully prepared from local ingredients. Someone in the community will need to have the ancestral knowledge for which plants, animals, and fungi may deliver the crucial ingredients for the elixir to work. And so we now turn to another secret ingredient that many trained in the Western scientific tradition have not yet recognized as mission critical for humanity’s success—it is time to talk about indigenous spiritual education.
Chapter 15 — Our Ancestors Were All Indigenous

You may have been born—like I was—into a post-colonial world so vast and all encompassing that all memory of your deep ancestry had been lost. I grew up in the Ozark Mountains of southwest Missouri on an industrial chicken farm that taught me how to despise where I was from. My childhood was filled with escapes into the nearby woods to find solace from the broken humanity that tortured my sensitive emotions. I grew up wondering if I was even human.

It was so painful to feel rejected by where I was born. And so disorienting to believe for several decades that I had no true home. Yes, my mother loved me. I had two brothers and a sister around after my parents divorced. I did have a home and grew up living in the same house on that big farm where daily chores included collecting the dead birds for compost and pushing a wheelbarrow filled with corn-stock feed loaded with hormones for the chickens so that our family was able to put food on our table and keep that familiar roof over our heads.

But I didn’t feel like I was from there. It was so obvious even when I was a mere three years old, playing amongst the other kids on a preschool playground and wondering why they were all so mean to each other. There was a lot of schoolyard bullying. Plenty of broken marriages. No short supply of drug and alcohol addictions. And a backdrop of crippling poverty so familiar to rural communities around the world.

It wasn’t until I was in my mid thirties that I discovered where my real Home is. I was working with the International Centre for Earth Simulation to promote an agenda for creating high-performance computing facilities dedicated to the holistic simulation of the dynamic Earth. During this time in my life, I was also being invited to give talks and workshops all over the world. As I traveled from place to place feeling aloof and ungrounded, I kept sitting into the story of “Big History” that tells us how everything evolved from the Big Bang 13.7 billion years ago all the way through to the present day. It was profound to discover how much I loved every landscape, no matter how scarred it was by irresponsible excesses from human hands.

My Home was the Earth. It was so subtle, so pervasive, so deeply embedded in the scientific story I had painstakingly learned through my formal education and beyond, that I was surprised by its permanence in my psyche. I always knew I was from the Earth. But my childhood upbringing kept me feeling separate from landscapes, divided against people, and philosophically levitated into an intellectual sphere presumably separate from all that is.

This realization that all of us are from the Earth is an ancient one. Had I been born into an indigenous culture, I would have learned the names of all my kin—what biologists clearly confirm to be true, which is that there is only one web of life on this planet and all of us are related to each other. In the absence of an indigenous education, I had to piece together the spirituality that enabled all sustainable cultures in human history to function as harmonious
parts of their landscapes. For they saw themselves as peopled-landscapes and not merely as people on landscapes.

Somewhere back in my own family history, there is a broken place where my indigeneity was stripped away. Like the “re-education camps” of British colonizers, I had my blood memory erased and replaced with a mythical story about being an American who is a citizen of the United States. My residence was in Missouri. I filed legal papers in my local legal fiction called Barry County.

Nowhere did this Russian doll of imposed identities—one packed inside the other—ever tell me which river sustained my mother’s bones or which patch of soil gave strength to my father. Only by rejecting the social world of my birth did I find hints of my true history. I felt more kinship with that churning stream that flowed across the edge of our farm; more familiarity with the fallen leaves beneath the hickories and oaks of the woodland hills near my home; and more connection with dogs, birds, bees, grasshoppers, fireflies, and deer than with the other kids who attended my elementary school.

I was indigenous without knowing it. And the story of human evolution bears this out. For the vast 99% of human history, all of our ancestors lived in tribal bands as hunter-gatherers. They organized themselves into bioregional life systems of human subsistence. Go back far enough in my white-fleshed, European-descended family tree and you will eventually find my great-forbearers among them. This is true for you as well.

Now back to that strange word I used a few passages back. What does it mean to experience life as a peopled-landscape? This might seem to imply that the indigenous worldview treats humans as embedded within and part of landscapes—which is true but not fully complete. For they also consider every living being, as well as many landscape functions involved in creating the conditions for life, as being peoples. There are salmon people, bear people, river people, and orca people if you happen to live in the Pacific Northwest. And there are hummingbird people, toucan people, jaguar people, and sloth people if you live in Central America.

This peopling of landscapes is fundamental to indigenous worldviews. It shapes how they engage in the ethical development of their children. And it is foundational to the spirituality that enables them to manage conflicts when actively participating in the web of life for their bioregions. As eloquently expressed in their Message to Little Brother, the Kogi people of the Santa Marta Mountains in northwestern Colombia have a deep devotional relationship to the life systems of their territory. They observed the subtle patterns of disruption high up in the mountains where rivers were becoming sick due to the harmful development practices of post-colonial Colombians along the coast down below. With a lifetime of training for their shamans to think as the mind of nature, the Kogi are deeply attuned to the health and wellbeing of life systems everywhere across the landscapes where they live. They learn from a very young age how to listen to the different pattern languages, discern their diverse intelligences, and consider their active roles in every decision they make in their daily lives.
The theologian and transdisciplinary scholar, Michael Dowd, has spent decades studying different religious and spiritual systems as they relate to environmental change. He has focused attention on the lack of moral capacity to be in right relationships with the rest of nature that is so starkly evident in our present context. He has also observed that the only human cultures that have ever been sustainable are all fundamentally pro-future in their norms and behaviors; they interact with their surroundings through personified relationships that are personal and sacred; and they live out mythic narratives that are interwoven into their daily practices about how to be in these right relationships.

Contrast this with the profound historical fact that there are zero examples of empires or civilizations that have proven to be sustainable. As these complex hierarchical systems of human organization spread out and degrade larger areas of land, while also creating internal instabilities through class systems and structural inequalities, they go through various expressions of decline, fragmentation, dissolution, and collapse.

A vital ingredient of the elixir for protecting bioregions is structural interdependence among diverse peoples—humans integrated with the many other ‘peoples’ of the landscape. And a vital ingredient for creating viable regenerative cultures is indigenous spirituality defined in these terms. It is so fundamental to their worldviews that you can find it in every ritual, as part of every ceremony, and woven into the ways they teach daily activities to their children.

My wife and I are taking this seriously as we raise our young daughter. We are teaching her to thank the different plants, animals, and natural processes that make every meal possible. In the community food forest where we live in Barichara, we have a morning ritual of having picnic breakfasts in the same places where we play games to interact directly with these relationships. And it is working—so far—our daughter Elise wants to feed our kitchen compost to the fledgling trees. She steps over lines of ants saying “sorry” for disturbing them. And she loves these other people. They are becoming interwoven into her life.

If we are to keep humanity from going extinct, this means at least some of us will become ancestors. And if we are to help create and live out regenerative cultures it means we will live as indigenous ancestors. A Great Remembering is called forth to embed us in this continuity of indigenous worlds—of which there are many. While those of us who have forgotten (myself included) may stumble awkwardly into this role, it is a narrative grounded in such profound truths that we will want to take great care to feel into its many nuances as we go about the work of regenerating the Earth.

Chapter 16 — Education for Bioregional Design

There has been a trail of bread crumbs throughout every chapter so far about one of the most important design pathways for restoring planetary health. This is the path of regenerative education. I find myself thinking about this topic in a broadened contextual frame of social
Learning because the formal institutions of education that most of us are familiar with are (a) largely inadequate at present; and (b) only represent a small subset of all learning that occurs in human communities.

Social learning focuses on the various ways that one member of the biological world gains insights and useful practices from any other member of the biological world. There is a huge research literature about the social learning among fish, birds, primates, insects, and even evidence that it occurs in plants and fungi. There are some researchers who find it necessary for methodological reasons to separate social learning from individual discovery—meaning they distinguish the learning processes for an individual figuring out how to do something on their own from the learning processes when an individual imitates, emulates, or is actively taught by another person.

This distinction matters for us too because there will be no design of regenerative bioregions in the absence of intentionally creating the educational processes that serve the systems of life for each particular landscape. We will need to take care and give thought to what needs to be learned, how to go about learning it, why these things matter so much, and when (developmentally speaking) the different aspects of learning should be woven together.

As mentioned in the previous chapter, every sustainable human culture in history has included a core focus on the cultivation of sacredness among ecological relationships that matter for human survival. Thus one foundation for bioregional education will be this cultivation of the sacred in a local and meaningful way. This introduces a cascade of implications about how to raise children, what the relationships are between work and family, how to structure time and space for the necessary rituals to be performed, and much more that warrants careful consideration.

My wife and I are actively grappling with these implications now as our daughter approaches her third birthday. During our transition into parenthood, we began an exploration of how to create a life system that is regenerative. There was a sequence of increasingly radical steps—moving from the larger city of Seattle to a smaller, family-oriented city in Eugene, Oregon; then almost a year living off-grid in a tropical rainforest in Costa Rica; followed by bike touring and nomadic wanderings for two months; and currently in Colombia where we have found a community of parents interested in homeschooling together as it relates to local economies and how we manage our households.

Every step of the way we have found obstacles and barriers to regenerative living. It is not easy to raise a child in the broken cultural landscapes of our current planetary context. What applies at this family level is even more complex to deal with for entire communities, let alone networks of communities weaving themselves at the territorial scale. Yet we must find ways to overcome these obstacles if regenerative economies are to take root in consciousness, practice, structure, and flow of human cultures in the next several decades.
We came to Colombia because we were drawn to a family that is living regeneratively in ways that are beyond our current abilities. They are a husband and wife with three small children who have practiced deep ecology in the spheres of early childhood education, homeschooling, permaculture practices, conservation science and field ecology, and in peace-building processes in the conflict zones of war torn regions in Colombia. We volunteered as extra adults in a three week long escuela del bosque (forest school) for children ranging in age from 3 to 8 while our daughter attended. It was so deeply clear that the only way to transform our lives is if we do so as an entire family.

This was one of the lessons learned by the father in this Colombian family. His name is Felipe and he has facilitated healing and restorative justice processes with people who previously participated in guerrilla violence, while under the mentorship of a famous Jesuit priest who has guided peace-building activities in Colombia for more than 50 years. It was Felipe who said that social transformation is not possible within communities at any scale smaller than the family. Interventions and regenerative processes must enable both parents, all children, and any extended family who is actively helping raise the children, to carry through wherever they might need to change for themselves.

Prior to this experiential inquiry into social learning, I spent six months extensively reading about bioregionalism and education programs—discovering that there was a lot of ground that had already been covered by others who had taken similar journeys before us. This enabled me to write a 25-page synthesis document that outlines 42 pedagogical themes for the design of bioregional economies informed by the wisdom of many other people.

Many of these themes are incorporated into this book. A few examples include learning how to live in place; dealing with grief and trauma; organize around the functions of landscapes; and study the developmental history of culture and ecology for each landscape. The collection of themes is an exploration into the fundamentals of what education needs to be as we make this Larger-Than-Moonshot effort to regenerate the Earth.

Of particular importance is the need to create bioregional learning centers for each regenerative economy that takes root in place. There will need to be ways of retaining and passing on knowledge about native species, how to build houses in the local climate using locally-sourced materials, what it means to have sustainable food systems in this particular place, and how to enact the performance arts that cultivate sacred relationships with local ecologies in deep and persistent ways. Donella Meadows described this in the same 1983 essay mentioned earlier—that the only way to move toward planetary sustainability is to establish bioregional economies that function as living systems, and that it is vital for there to emerge a global network of bioregional learning centers that figure out how to do this.

The design pathway for regenerative education maps well onto the five step process for Integrated Landscape Management, appropriately adapted to the formation of bioregional learning centers: (1) Gather key stakeholders and create a functioning collaborative process; (2) Map the bioregion and its educational needs; (3) Construct scenarios of future change and use
them to inform how people learn in the bioregion; (4) Create a shared agenda (or roadmap) for how to move sequentially toward the most desired futures; and (5) Set up monitoring systems for developmental evaluation that help move the community toward these future outcomes.

Imagine if every bioregion on Earth did this for education broadly enough defined to include all forms of social learning. Now go one step further. Imagine a global network of these bioregional learning centers engaging in exchange programs; sharing their unique strengths with each other, learning and improving together through convenings and other collaborative engagements. When I wrote the document with 42 pedagogical elements for bioregional design, one of the themes was to create a “passport” system that replaces diplomas and college degrees.

As a person visits different learning centers—which includes all of the existing ecovillages, permaculture camps, regenerative farms, agroforestry projects, landscape restoration efforts, and community resilience activities—they get something like a stamp in their passport. Did you learn how to build cob houses at Rancho Mastatal in Costa Rica? Here’s your stamp. Have you attended a mindfulness meditation retreat at the Monastic Academy in Vermont? You get another one. Complete your online certificate in ecovillage design with Gaia Education? Here’s one more.

Over time, these “stamps” become the experiences written onto resumes that are shared alongside reference letters of support from prior mentors, teachers, and peers. All learning has an active focus on regeneration so that another pedagogical theme is met... what I call learning by regenerating so that we don’t waste time foolishly separating theory from practice.

Universities can perform important “bridge” roles as they continue sending their students for study abroad and immersion programs. They also have roles to play in the deeper research projects that can be managed through their various institutes, centers, and labs. Yet I have found the bureaucratic entrenchment of universities and their struggles to continually secure research grants to greatly weaken their capacities to participate in these processes. It seems more likely that individual professors and specific graduate students will continue being the weavers of these relationships while higher-level administrators continue focusing inward on the survival of their increasingly inadequate institutions.

This way of weaving social networks of people within formal education together with the thousands of informal learning communities enables us to build up the education systems that humanity urgently needs in these transformational times. Just like for bioregions themselves, it is important to induce an evolutionary transition of functional interdependency among the many thousands of existing learning centers around the world that already offer regenerative programs today. This would be overwhelming if it was a giant database or a comprehensive list. But organize it around the bioregions themselves and all of a sudden it becomes manageable to implement.
Among the topics to learn—the skilled crafts associated with growing food, processing local materials, constructing natural buildings, fermentation and food storage without the need for electricity, weaving textiles to make clothes and baskets, permaculture to regenerate soils and restore ecosystems, group facilitation and governance practices, how to raise children, and a host of other things related to living sustainably in place.

When each bioregion sets up its learning center (or existing places of learning recognize how they already play this role), the curricula need to become better integrated at territorial scales to address the urgent systemic challenges of each bioregion. As more learning centers organize themselves in this way, it clarifies how their cultural and ecological uniqueness sets them apart from other bioregions around the world. The coherence is held through the nesting of systemic health goals from local to territorial, bioregional to planetary.

We may be able to re-invent education in this way in the span of ten years. All the pieces are in place. Many of them decades old with deep reservoirs of embodied and institutional knowledge. What remains to be done is organize them into bioregions and link them one to another until a global network pops out.

Chapter 17 — The Sneaky Topic of Carrying Capacity

There has been an **unthinkable topic** running through this entire book. It has to do with the size of the human population. You might have noticed that I give only peripheral roles to cities and formal institutions—if they get mentioned at all. This is because I have come to the conclusion that it is the abundance to be found at the edges of ecosystems where regenerative innovations might take hold and root themselves for the long 50-100 year period of transformation that will unfold around us as we live (or die) through it.

Cities have only existed during the Holocene. They arose when the Earth’s climate became relatively stable and warm for a 10,000 year period of time. It is noteworthy that they were always set up near a stable water supply with land surrounding them with sufficient fertility to provide food to their residents. Only when globalization arose exponentially around the use of fossil fuels in the last two hundred years did it become economically feasible to ship food over long distances to feed dense urban populations. As water supplies became contaminated with sewage and industrial runoff, these same fossil fuels were involved in the construction of concrete and steel buildings for the water treatment facilities.

Take away the stabilizers of the Holocene and the abundant supply of cheap fossil fuels and this model of social organization becomes much less tenable. There is no evidence in human history that cities have been sustainable prior to the Holocene. They have always depended upon environmental stability combined with access to adequate amounts of energy to support their scales of economic activities. This opens up the deeply disturbing thought that most of the world’s cities may go away as the population plummets.
But why do I believe the population will decline?

A foundational book was published in 1977 by the human ecologist William Catton Jr. It has the assertive title of *Overshoot: The Ecological Basis of Revolutionary Change*. This classic environmental text was widely read among ecological thinkers at the time. Most people today do not know of its existence. Yet this book lays out in clear terms how the cultural evolution of humanity has exceeded the Earth’s capacity to support our massive population as it has grown in the last few hundred years.

Catton introduced the key concept of *carrying capacity* to carefully walk the reader through the process by which humanity has temporarily exceeded it. Carrying capacity is usually defined as the number of individuals in a biological population that an environment can support indefinitely—assuming the environment does not change during this time. The overshoot occurred during a period that Catton named *The Age of Exuberance*, when the illusions of technological progress seemed capable of improving the quality of life (as experienced by the beneficiaries of colonization and resource extraction) for an extended period of time. The first thing to know is that carrying capacity is not a static number. Many people who are familiar with the term will criticize it by saying real ecological capacities are not static or fixed with the passing of time.

These people are correct. There is a dynamic interaction between a growing population and the ability for its environment to change in accordance with it. It is possible for the population to approach the maximum capacities for depleted resources to be renewed autopoietically and stabilize at this level. But this is only one scenario among many that are also possible, others of
which may be more likely to occur. William Catton Jr. introduced the following graph to explain the four types of scenarios that are possible.

The solid lines represent the cumulative impact on an environment—labeled as the ecological “load” for the population being considered. Ecological load is a combined measure for the size of a given population together with the per capita use of resources. It can grow by increasing the number of members or by increasing per capita consumption. This nuance is important to keep in mind. Dashed lines present assumptions about how the carrying capacity works for the environment being studied. We will explore these assumptions to make sense of the graphs and see how the human population is already in overshoot and therefore must decline at some point in the near future.

Scenario A presents the situation described above. There is an assumption that the carrying capacity is a fixed number that doesn’t change as the ecological load of the population goes up. With the passage of time, this scenario shows the population stabilizing at the level of maximal consumption and remaining there indefinitely into the future.

Scenario B adds the feedback mechanism for environmental degradation. When the ecological load goes beyond the regenerative capacities of its environment, there follows a pattern of drawdown of available resources. This drawdown reduces the carrying capacity to a lower level.
This scenario keeps the assumption in Scenario A that the new (and lower) capacity is where the population stabilizes and remains at this level indefinitely into the future.

Now look at Scenario C for a more complex and realistic picture. Here the ecological load of the growing population is able to rise exponential and temporarily exceed the carrying capacity. When it does this, the environment becomes depleted of its non-renewable resources and the carrying capacity goes down. The population is now in overshoot and reaches a peak before declining rapidly. Yet as the population goes down there is a decrease in its ecological load, enabling the carrying capacity to rise again (but not reaching its previous height) because renewable resources are replenishing themselves alongside the continued depletion of non-renewable resources. A fluctuation sets in that continues this dynamic pattern indefinitely into the future.

Then we get to Scenario D where the assumption gets added that the population exceeds its carrying capacity due to the discovery of a temporary resource that it extracts—enabling the overshoot to intensify greatly for a short period of time—which has the corresponding effect of dramatically degrading ecosystems and reducing carrying capacity even further. There is a “temporary” carrying capacity line to indicate the brief period when this non-renewable resource is drawn down in order to grow the population beyond its “sustainable” carrying capacity based exclusively on renewable resources.

Note also that this graph is intentionally crafted to describe humans because there is a period early in time when carrying capacity was going up. This was because the human ability for cumulative cultural learning enabled the emergence of new technologies that were more effective at extracting and utilizing resources. As humans discovered new uses of fossil fuels (or created technologies to gain access to more of it), they increased their temporary carrying capacity while drawing down these non-renewable resources.

Also important is what happens on the right side of this graph. Note how the carrying capacity and population both plummet. The graph depicts the pathway of regeneration where the much lower population is able to grow itself back up to a now much decreased carrying capacity based entirely on renewables. Another possibility also exists that is not presented in the graph. This is the possibility that the degradation of environments is so extreme that the population goes to zero. This would be the extinction event for humanity. One of our stated goals in this book is to follow the path of regeneration and do our best to avoid this outcome. Thus our design pathway will need to track that small section of graph in Scenario D where the population increases up to the true carrying capacity after the temporary overshoot has run its course.

With this nuanced understanding of carrying capacity, we can now consider the question of human overshoot. Is it the case that our growing population combined with intensifying per capita consumption has outpaced the ability of our environments to regenerate vital economic inputs? The answer is clearly yes. There is an annual Earth Overshoot Day measured by the aggregate of ecological footprints for all humans on Earth that is currently at July 29th—
meaning every day afterwards in the year 2019 was a day of material drawdown that exceeded its regenerative capacity. We are in excess of what our planet can support when measured in terms of our ecological load.

Did we manage—through some combination of technological advance and environmental discovery—to overshoot our carrying capacity in a way that greatly reduces it in the future? The answer to this is also yes. The human population exploded after the “Green Revolution” when fossil fuels began to be used for industrial agriculture. There are now less than 50 crop cycles left before the Earth’s topsoils have been depleted. All that is needed by climate change is to produce the right combination of floods, droughts, and wildfires to shut down two of the breadbaskets on Earth and a billion people will starve within a year. We are heading for a perfect storm of harms in the mismatch between ecological decline and growing consumptive need.

Might it be possible that this rapid decline in human population occurs so quickly that we go extinct? That remains dependent upon many factors. There are scenarios for near-term human extinction associated with the rapid meltdown of multiple nuclear power plants, exponential release of methane from melting permafrost that creates high surface temperatures cross the globe, and the emergence of militant artificial intelligence with swarm drone attacks—among other creative possibilities—that could wipe us out. This is why it is so important that we intentionally choose the path of Earth regeneration. If left to chance, we really could go the way of the dodo.

William Catton Jr. offered two ways that humans managed to temporarily exceed our carrying capacity. The first was the “discovery” of the New World when a European model of imperial conquest and colonial extraction was spread to North, Central, and South America. This was a primary contributor to the growing wealth (and improving livelihoods) of those who benefited from this process. It enabled the cultural context to feel like the world is filled with abundance and that progress can always be employed to tackle any problem. In other words, we can grow our economies ever larger until current challenges get addressed by the optimistic delusion that there will always be accompanying increases in prosperity.

This is how the mindset of progress through technology really took hold in the cultural foundations of the newly globalizing economy. Now we can see the second way that humans have managed to overshoot our carrying capacity. With the discovery of fossil fuels, there came about a once-in-the-history-of-the-planet opportunity to utilize 200,000,000 years of captured sunlight in the fossil reservoirs of coal and oil. As the human population exploded around the “industrialization” of agriculture—which depends on oil in many foundational ways—these reservoirs have been rapidly depleted. A destabilized climate is but one symptom among many for this runaway process of cultural evolution.

In roughly one-millionth of the time that these non-renewable resources took to create, we have lived out 200 years of exuberant growth that felt as inevitable as the Myth of Manifest Destiny on which it was all built. Now we have the unenviable situation where technological
advances combined with cultural norms devoted to a myth of self-serving progress have dramatically reduced global biodiversity, consumed a majority of the planet’s available metals, depleted half of its topsoils, and polluted all of its environments.

Wastes have built up and resources have gone down. All of this occurring faster than the biosphere can process. We have a human population today that is nearly 8 billion strong. Whatever our carrying capacity was before the massive degradation of Earth’s diverse landscapes, it is decidedly lower now. And as we approach the twilight of fossil fuels—global production of oil peaked in 2010 and global warming makes it profoundly foolish to burn any more—the ability to run our globalized system at this heightened level will soon be at an end.

A population crash is coming. It will very likely occur in our lifetimes. The famous Limits to Growth study published in 1972 has a business-as-usual scenario that has tracked reality with disturbing accuracy. This scenario projects that resource constraints will lead to disruptions in supply chains, followed by a rapid decline in the human population that begins around 2030. The researchers involved did not know about global warming at the time. Our situation is likely to be even worse than this very troubling forecast.

It is a serious consideration that we will need to guide humanity onto the path of regeneration at the bottom dip of that Scenario D curve in the graph above. Keeping our population from hitting zero is one of our necessary targets. Setting the Earth onto a path that brings us back within planetary limits is going to need to happen in a period of time more dangerous than anything we have dealt with before. This is why I started the book by talking about planetary collapse. Yes, there are powerful tools and frameworks available to us. A great deal is known about how to envision and enact a design pathway for creating bioregional economies that embody the principles of regenerative economics.

Yet we must enact this vision during a time of intensifying militarism, growing conflicts for increasingly scarce resources, and prospects for suffering that are beyond imagination. I do not offer a naive pathway. My intention here is to share what I believe is necessary if humanity is to survive this ordeal.

And we will need to have a nuanced understanding of carrying capacity if we are to track reality with discernment and improve our chances for success.

Chapter 18 — The Beautiful Dance of Death in Ecology

It is deeply important that we learn to see humans as ecological systems so that we can practice designing cultural evolution around the patterns of ecology that enable Earth regeneration to occur. The last chapter was another practice in grief therapy—recognizing that humanity has
overshot its carrying capacity and will have to “self-correct” both in terms of population levels and consumption behaviors.

This offers us an opportunity to embrace the role of death in living systems. Regeneration involves many dynamic processes where nutrients and energy are continually cycled. Your body contains within it the births and deaths of countless bacteria who help digest your food on a daily basis. This continual cycling was called robust circulation in the framework for regenerative economics presented in Chapter 6. The ability to keep being alive is a dance with death that is truly beautiful, when we learn how to see it properly.

Evolution plays out in everyday life at multiple scales that interact with each other in what are often surprising ways. As individual species participate in food webs, they feed off of each other and become meals themselves. At population levels, they continually express a diversity of physical and behavioral traits that ebb and flow in the dance of changing environmental conditions. And at ecosystem levels, they move through cascades of birth, death, and renewal for what is known as ecological succession.

This is the pattern of going through stages where the ecological community in an earlier period becomes unstable and begins to collapse, making nutrients and evolutionary pathways available for other species to disperse and replace many of the earlier species. In a degraded (or otherwise disturbed) landscape, there are pioneering species that take root and establish themselves in the poor conditions available at the time. There might be specific tree species that do not require large amounts of nitrogen yet “fix” some of it in reactive form for the soils to accumulate this vital input for other species. When the pioneering tree dies, it’s body decomposes into the soil and disperses more nutrients—improving the conditions for other plant species that require them for their survival.

If the conditions remain conducive to ecological succession, the first stage gives way to a second that makes way for a third until eventually the ecosystem reaches climax and has the greatest biodiversity that can be sustained in this most mature form. Climax ecosystems have the feature of being self-stabilizing because so many niches have been filled that the network of relationships becomes resilient against disruptions.

Note how the evolution of ecosystems is a dance of death. Earlier pioneer species flourish and may grow to quite large numbers within the landscape for a period of time. Yet it is their die-off that gives way to ecological succession. The expansion of complexity in terms of numbers of available niches, levels and pathways of dynamic feedback, and self-stabilizing capabilities is a march of death and renewal at larger scales than most humans pay attention to. This may help us come to terms with the die-off of our own excessive population that is going to be a highly visible feature of the Earth regeneration process in the next 50-100 years.

Going back to William Catton Jr. for a moment, it is intriguing to reflect on the way he framed the use of agriculture in his book about overshoot and collapse. He observed that the invention of agriculture was an intentional management system that destroys climax ecosystems,
We are lacking the ability to embrace ecological succession as the pattern of increasing complexity that follows the death of pioneer landscapes. This means recognizing that agricultural lands and many urban environments match this description in ecological terms. Their succession will be how regeneration spreads across the Earth in the midst of human turmoil. Our embrace of death is how we cling to life as part of the biosphere that evolved us into being in the first place.

You can see why indigenous spirituality is so important as well. Our ability to be in relationship with other non-human peoples is how we find solace amidst the losses that would overwhelm us with loneliness if we believed only humans to be important in the world. The African concept of Ubuntu tells us that “I am because we are”—but this only makes sense when the “we” is inclusive of life’s web and does not sever itself from the evolutionary sources of our larger family tree.

Intending for ecological succession need not mean we desire for humans to die. Yet the evident lack of adult leadership in today’s extractive world tells us that we need different leaders who are mature enough to accept death in order that life might once again be redeemed as sacred. We design for regeneration of landscapes so that ecological succession might occur. And we need to do this as if we were living in the midst of a world of extreme complexity.
remove the extractive human management systems that force succession to a halt in order to do this.

The deaths that occur were already baked into the equation before any of us alive today were born. The temporary rise in carrying capacity for our species came about through the discovery and use of fossil fuels many generations before we were born. The planetary collapse was started prior to the first breath to fill our lungs. And the regeneration of Earth will not be complete before most of us take our last gasps of air.

And so we must cultivate the spiritual capacities to treat ecosystems as sacred if our descendants are to find niches in which to flourish after our excesses have come to an end. This is the dark secret juxtaposed against the silver lining of our potential survival as a species. Now that we are all in the crucible of change, it is time to pull back the veil and accept this shadow to its full depth if we are to guide the world into regeneration with eyes wide open.

This is how humans might rise to the challenge of service for a biosphere in crisis due to the actions of our own species. Death is the dance of beauty that perpetuates life.

Chapter 19 — The Gaia Hypothesis for Earth Regeneration

Some readers will be familiar with the Gaia Hypothesis put forth by James Lovelock. It claims that the Earth has an interconnected network of ecosystems that enable autopoiesis to occur at the planetary scale. In other words, the Earth’s biosphere contains within it a web of biochemical feedbacks that keep vital inputs for continuing life within their necessary ranges.

For example, the high levels of oxygen in our atmosphere tell us that there is life on Earth. How do we know this? Because oxygen is highly chemically reactive and if there were no living organisms to continually produce new oxygen, it would quickly react away and come to chemical equilibrium at a much lower level. Similarly, the levels of methane in the atmosphere are far higher than they would be in the absence of continual output from the metabolic activities of bacteria all over the planetary surface.

When we step away from the narrow focus on our own species, we begin to see that all life is robustly and continuously interconnected with all other life. Land animals only exist because there was an ancient collaboration between plants and fungi to create the mycorrhizal roots that break rocks apart and convert them into soils. A continual exchange takes place between plant roots, fungal threads under the ground, and bacteria that feed on their waste products (while “fixing” nitrogen in the soil to feed the plants) that is a dizzying dance of co-creation.
This dynamic reproduces itself at all scales of the living Earth. It is now known that moving tectonic plates grind up rocks that push high into mountain ridge lines. These rocks carry calcium and other minerals that weather away in the ensuing rains that fall upon them and fill rivers below. As these minerals spill into the ocean they become the bodies of shell-making animals—that fall to the ocean floor when they die and replenish the calcium supply for the next round of rock cycling deep into the magma layer below.

Fascinatingly, this deep pattern that occurs on timescales measured in millions of years is what enables the Earth’s atmosphere to maintain its overall temperature in a range that allows life to continually thrive at the surface. The insights about how living ecosystems of our planet are intertwined give us much to work with in regenerative design. We can become pattern makers of meaning who see the interactions of life with life and then apply this knowledge about how the patterns work to support the thriving of life’s complexity.

In the last two chapters, we explored what ecologists have to say about the limits beyond which a single species cannot go for very long periods of time. The larger ecosystems that create Earth’s biosphere have self-regulatory feedbacks that bring the overshoot back into check. In this way, we humans are no different from any other species. We need to recognize our limits and behave responsibly while holding them in mind.

I find it helpful to describe Gaia as a personification of the 3.8 billion year process that created all of the species to ever exist on Earth. When the first bacteria arose in the watery sludge of shallow oceans, a process of dis-equilibrium was begun that has kept reactive chemicals in play that otherwise would have long ago been spent. This dynamic of chemical self-organization has run perpetually for more than three and a half billion years!

We tiny humans with such fledgling histories that number in the hundreds of thousands of years (or more generously, five to six million for our ancestral hominid line) are newcomers on the stage of life. Our part may be quickly played out. Or we could offer gifts of gratitude to our Earth Mother that let us stick around for a little while longer. But either way, we will someday go extinct too. And it is very likely that Gaia will continue for long after we are gone.

The gratitude we can feel for our impermanence is a source of inspired action to serve the regenerative drives of Gaia as we step into our new roles as awakened humans who see the imbalances created by our excess. Unlike other species that overshoot themselves, we can perceive and understand what is happening to us. And this opens up the opportunity to live intentionally in these times with eyes wide open.

It is quite likely that Gaia will regenerate the Earth if we go extinct in the next 100 years—or similarly if we disappear in 100,000 years. So our task is not to keep Gaia alive. That is not really the issue here. Our real task is to become grateful stewards to Gaia so that the conditions conducive to life include those necessary for our own survival as a species. This opens an ethical inquiry that we are going to have to address. Do humans need Gaia? The answer is an absolute yes. Does Gaia need humans? Maybe not. Who are we to say?
Evolutionary biologist E.O. Wilson—in his book *The Social Conquest of Earth*—described the improbable walk of evolution that gave rise to humans. He carefully explained that a long sequence of evolutionary steps were needed to give rise to a species capable of complex social organization combined with the emotional and semantic skills for compassionate stewardship. Astrobiologists who study life’s origins have realized that microbial organisms could be quite prevalent in the Universe. There are likely to be hundreds of millions of planets where bacteria have come to life at some point in the 13.7 billion year history of the cosmos. But the steps involved in creating multicellularity, and later social groups of animals, are much more difficult to achieve. There may only be a handful of planets in all the cosmos where the conditions are right for the emergence of multi-cellular life.

Add the constraints for *eusociality*, which is the emergence of distinct social roles associated with complex social organization, and the number goes down even more. This includes the ants, bees, termites, and wasps among insects and only a handful of mammals including dolphins, whales, and of course humans. Yet so far only one species that we know of in the grand panoply of life has emerged within these constraints that is also capable of feeling deep sentimental emotions, creating tools of discernment to see vital patterns of meaning, and experiencing reverence and awe for the sacred. We humans are something special within Gaia that enables the Earth to feel for and love the Earth—and this is said without being hubristic or condescending. I say it to express the profound loss our planet would endure by letting humanity go extinct prematurely just as this new expression of planetary consciousness is taking form.

For example, did you know that humans have invented a suite of technologies that build profoundly new perceptual systems for the planet? One of the most powerful of which is the *Earth Observing System* comprised of observational satellites in low orbit just beyond our atmosphere, environmental sensors spread across many landscapes, data processing centers for analyzing and visualizing what is observed, and computational models for creating scenarios of past and future change that correspond with this massive aggregation of observational data. These are new *capacities of perception and cognition* that our planet gained when our species began learning how to understand its home planet in holistic ways.

We are expressions of the Gaia Hypothesis. Humans can intentionally and purposefully guide the evolution of planetary processes back into stabilization and harmony among the numerous complex ecosystems of the Earth. Much of our history prior to the Holocene was lived out in small tribal networks of regenerative cultures that failed or succeeded depending upon how they managed social affairs in the context of their local ecological realities. When the Holocene began, there arose many empires and civilizations across the planet that consumed or displaced these regenerative cultures as they went through their own boom-bust cycles of overshoot and collapse at regional scales.

And now we find ourselves with the Holocene at an end having newly created abilities to perceive as the planet in its entirety. These technological capabilities are at risk of being lost
when the current extractive system runs its own pattern of collapse in the next few decades. How do we safeguard and protect things like the Earth Observing System so that they can enable us to track our progress getting back within the Planetary Boundaries later in this century? If humans go extinct prematurely, will Gaia never again see and love itself through similarly competent and compassionate eyes?

At the heart of Earth regeneration is a new story about what it means to be human. Those of us doing this sacred work will need to find deep reservoirs of love and commitment to the continuation of our species if we are to make it through to the other side. Our new “hypothesis” is that we can become the active managers of homeostasis for our living planet. Entailed in this is the sentiment of self-love imbued with humility for the preservation of our own kind as we stumble into planetary stewardship.

Many among us are still too traumatized and filled with grief to be capable of this self-love. Our loss of connections to ancestry and landscape have hurt us too much. So we must also learn how to regenerate our fellow humans so that more among us can live into this expression of self-love in the coming decades. We have a beautiful ancestry as part of the 3.8 billion year period of biosphere integrity that enabled us to join the dance of life so late in the game and become a powerful disruptor to ecological harmony.

How might our power be directed in the healing arts of regeneration across all necessary scales in the decades to come?

Chapter 20 — Can We Bring the Amazon Rainforest Back to Life?

Are humans powerful enough to destroy the forests of an entire continent? Early in the modern era when industrialism was just getting started, there was a feeling of endless abundance that made it hard to imagine that humans could deplete all of it. And yet, here we are a mere two centuries later and the extractive destruction of our industrial machines has wrought havoc upon the entire Earth.

Clearly, we are more powerful than our recent ancestors realized.

The question I want to explore in this chapter is whether this power might be great enough to perform what seem like miracles today—now that we are much more aware of our destructive capacities. Specifically, I want to invite a conversation about the seeming impossibility of bringing the Amazon rainforest back to life.

Here is our present context: Current rates of deforestation reveal that the Amazon is blazing through irreversible tipping points. The existential anxiety associated with a confluence of global change patterns is being exploited by powerful financial interests to place xenophobic,
fascist leaders in the top positions of formal political institutions. These sociopaths then go on to enact policies that accelerate the destruction for an end-game of wealth hoarding in preparation for ecological collapse.

This is the Sociopaths Dream I talked about in Chapter 5. They are winning—for now. Who wins in the long run depends on how well the regenerative practitioners can stay in play for decades and centuries beyond the present. Can we perform a beautiful dance with death and bring something this large and complex back to life?

Researchers who study the Amazon at large scales have found that within the next 2-3 years it is likely to catastrophically collapse and break apart due to the fragmentation of its forest canopies and breakdown of ecological corridors. The great hydrological pump of evaporation and condensation cycled through these webs of life will not be easily turned back on after it comes to a halting stop. The species that go extinct in the process will take millions of years to evolve again, if conditions are conducive to planetary recovery. On shorter timescales, the regeneration of soils and forest canopies will take between decades and centuries to bring back to full maturity depending on local geologic and ecological conditions.

Now imagine this... might it just be possible that a network of Earth healers comes together around key points of confluence where connectivity was lost and weave a tapestry of reforestation that brings the hydrological pump back to life? Try to visualize the pattern. A thousand small-scale permaculture projects. Each initially a seed of regeneration in a nook or cranny of some small tributary or flood plain. Some of these people speaking Spanish. Others Portuguese. Quechua spoken in some places. A blend of colonial languages together with indigenous, all interwoven with the whispered languages of rivers and birdsongs, rustling leaves and jaguar purrs.

Do the expanding tendrils of restoration flow along the riverbeds? Might they jump across valleys and drop their seeds with the migratory flight of birds? Do humans sprinkle them into bogs and marshes as they row up and down watery canals? Is there a map to guide our progress, tracking the capture of carbon and retention of water in root systems of plants? Do birdwatchers monitor the spread of fruiting trees and bushy shrubs with the passing seasons of flying migratory birds?

Can such an ambitious thing even be done? I ask this question in earnest. For if we are to regenerate the Earth, it will be necessary for us to believe we can do less ambitious things like restore the Amazon as it spreads across an entire continent. We need to learn how to see such grandeur in our abilities to heal the world if we are to succeed in the timeframes that we have available to us.

Imagine the people who today are storing native seeds and growing plots of forest on small parcels of land. They work together with other people who construct natural buildings with local materials that are climatically appropriate to where they live. Some among them grow local plants and manage livestock in ways that mimic ancestral patterns for the ecosystems that
previously existed on their landscapes. Education programs are designed around the raising of children and preservation of cultural knowledge appropriate to each place.

Coordinated efforts are made to convene key stakeholders, map the local terrain, set up financial instruments for investing in the value created around local economies that support the cultivation of ecosystems, and increasing numbers of outsiders walk away from corporate treadmills to become servants of Gaia—voluntarily for some and through forced migration for others as climate-related catastrophes push them into new livelihoods.

Drumbeats of war can still be heard around the world. Dictators continue to rise and fall with xenophobic zeal to quell the emotions of anxious masses. Yet somehow, the Amazon begins to recover. I juxtapose this way on purpose because I want us to feel into the complexities involved. This is not going to be easy. And still it must be done. So I paint these scenarios in earnest to see if a viable pathway might still be found.

For example, do the world’s universities that are currently on the payroll of agribusiness companies manage to shift their curricula to agroecology and indigenous knowledge systems? Are technologies like blockchain and virtual ledgers put in service to tracking biodiversity and carbon capture in the manner of the Regen Network that supports regenerative efforts in this way? Do business schools transition to only teaching place-appropriate life systems as they relate to economic activities, informed by the sciences of sustainability and social justice?

Consider how the Amazon is structured. There are giant mountain ranges like those of the Andes that provide initial contours to the land. These create vast networks of rivers that all drain into the ocean—some of which fill the basin of the Amazon. Alluvial plains spread out in open spaces below where human inhabitants have lived for at least 13,000 years. Many of their languages now forgotten and centuries of colonialism have left their cultures in tatters. Other indigenous groups have remained intact and hold the front lines of defense against mechanized onslaughts to what remains of the intact ecologies that now fragment across the continent of South America.

How can the islands of demonstrated capacity to live sustainably in these places be safeguarded against destruction? What can be learned from them to construct new life systems that might prove sustainable during this difficult regeneration process? Who will provide money to them? Where will the food be grown? How will energy be produced? What systems will be set in place to remove pollutants from waterways? How might soil health and microbes be employed in service to regenerative design?

There are a thousand questions to ask and a million answers to live out.

Holding all of this complexity in mind, let us imagine a scenario that may not be how things realistically play out, yet can help us think into the possibilities. Imagine that we adopt the two frameworks mentioned earlier—Integrated Landscape Management combined with the Principles for Regenerative Economics—to guide the cultural evolution of land-use practices
across the entire Amazon Basin. This means we create a coordinating entity whose task is to set up Elinor Ostrom’s governance system for managing a common-pooled asset for the diversity of landscapes through which these waters flow.

The mission of this coordinating entity is to bring the Amazon Rainforest back to life. It defines success by the re-establishment of vital ecological corridors and regrown surface areas that succeed at bringing the hydrological pump back into a self-sustaining flow. Presumed by this is the formation of prosocial groups that can cooperate effectively for the tasks under their jurisdictions. So we can see that more frameworks are involved than we will go into here. Let us explore how to set up the management frameworks for entire landscapes so that regenerative economies might be cultivated across them.

A critical question to begin with is Who is the “We” for this effort? It cannot be all of humanity in any practical sense because people in other parts of the world will have their hands full regenerating their own landscapes. The diverse peoples of the Himalayas, for example, are going to be kept busy maintaining peace while safeguarding water supplies as mountain glaciers that feed their rivers continue to disappear. It makes sense that those included in the decision-making process are the peoples living in the Amazon Basin.

Politics immediately enters the scene. How do indigenous leaders currently being assassinated for environmental actions transcend their conflicts with foreign investors who care more for profits than life and happily hire guerrilla fighters as mercenaries to execute these murderous tactics in service to wealth extraction? Does the consolidation of land by wealth hoarders keep regenerative practices from spreading across fence lines built with barbed wire and stacked rocks? This question of who is included really matters for the ultimate success of the effort.

Another factor my family has experienced during our time living in Costa Rica and Colombia is that many of the regenerative projects are lead by “gringos” who moved to these places from elsewhere in the Western world. How should indigenous peoples, campesino farmers, people living in cities and towns, and foreigners who relocate to participate in regenerative efforts come together and make decisions? Does a local person with less ecological training have greater say about what should be done simply because they are local?

Conflicts of interest are always present in diverse groups. The ProSocial process—or other effective methods for facilitating group decision-making—can help with the setting of clear intentions, articulation of shared purpose, and identification of membership for those involved. What we need to emphasize here is that these social evolution components are just as important as the ecological design components related to restoration of the landscapes themselves.

Now let us add some of the scenario planning elements into the mix. As the primary groups form around how to manage different bioregional projects within the larger Amazon Basin, they will need to have high quality computer simulations for how things are likely to change in 5-10 year, 20-50 year, and 50-100 year timeframes. The computational models for ecological
succession of the Amazon as a whole system indicate that its unraveling will create a cascading collapse of planetary-scale weather patterns, regional-scale hydrological patterns (including soil formation and recharging of aquifers underground); and local replacements of ecosystem types.

What these simulations reveal is that as the Amazon passes a tipping point when 20-25% of the land area is deforested (combined with a related tipping point for measures of fragmentation across the basin) is that the forest is quickly transformed into grasslands and savannas. The loss of biodiversity is stunning. Planetary climate jumps onto a different trajectory. The patterns shift in lock-step from local to global in ways that are extremely difficult to turn around.

How do people working in a high plains region of the Andes support the spread of water so that an “upward cascade” might bring some of these larger-scale systems back into synch with local changes from one sub-basin to another? Is it physically possible to do this after the tipping points have already been crossed? The frightening truth is that we are all about to find out. Momentum in the globalized economic system is already driving us beyond the point of no return and very few interventions have the plausibility to bring it all to a halt in the 3-5 year timeframes that are left before these tipping points are crossed.

So we need to prepare for the most likely outcome—even as some among us still strive for the best as its prospects for success decline year by year—because the changes are happening at exponential rates, compounding and accelerating each other with every passing day. With this in mind, let’s see how the whole system might be engaged to self-organize our local actions around coherent goals across the entire basin.

Those seeking to bring the Amazon back to life will need to monitor and track their progress. Key measures include changes in soil carbon, diversity of species and canopy structure of forests, formation of ecological corridors for the movement of migratory species, and total embodied carbon that is captured and stored. Evaluations of river flows, nutrient cycling, changes in weather patterns, recharge rates for aquifers, and other key factors may need to be actively monitored as well.

There are current efforts to combine these kinds of data from sensor networks with digital ledgers that track the creation of value as ecosystem functions improve. When combined with the Principles of Regenerative Economics we can see that these value-creation activities are economically important and should be recognized in ways that empower local actors to “do the right thing” in relation to desired outcomes at the whole system scale.

One way to do this is to create investment platforms that track regenerative efforts until key outcomes are achieved. For example, if carbon capture and storage is a goal there can be financial tools to issue loans and credits to those who plant trees or grow the amount of organic carbon in their soils. The measurement tools used for tracking these environmental factors can be verified using robust data analysis. Once verified, the financial resources to
continue (or expand) these activities become available to the people engaging in local efforts with track records of success.

Here we can see that a robust circulation of financial resources aligns with empowered participation for local groups, to co-create edge-effect abundance where human and landscape interact. These are expressions of regenerative economics embodied by the people living them out as part of the larger regeneration effort. And of course honoring community and place are how the indigenous peoples have survived across millennia so this is a factor too.

The loss of land area due to deforestation combined with severed connectedness in the privatization process have contributed to the Amazon’s death. So therefore it must be the reforestation of land combined with actively seeking connectivity that makes possible its resurrection. Whether this happens in 50 years or 500, the outcome is the same. Our only way to bring the Amazon back to life is to weave a tapestry of regeneration across an entire continent—and do it together around shared objectives and goals.

I am taking great care here to allow that it simply might not be possible to resurrect the Amazon as we have known it until now. Yet if we are to learn how to regenerate an entire planet, we will have to practice thinking through (and acting out) the complexities involved at scales this large in the years to come.

Chapter 21 — Safeguarding the Himalayan Water Supply

It is truly sobering to think about regenerative design at such large scales. Collapse of the Amazon is imminent and gives us the opportunity to practice working with grief while also holding the complexity of what it will mean to restore its ecological functions at continental scales if we choose to take this on as our mission.

Now let us go farther and make things even more complex. Consider one of the most important strategic reserves on Earth—the Himalayan water supply. More than 3 billion people depend on the hydrology of this region for their survival. So do several million other species living in the lush sub-tropical forests of Southeast Asia. The International Centre for Earth Simulation paints a sobering picture of the complexities inherent to this region:

“The Himalayas are a young seismically active mountain range arching across the Tropic of Cancer in Asia with over 100 peaks exceeding 7000 meters that are still being pushed upwards by the tectonic collision of the northward moving Indo-Australian Plate with the Eurasian Plate. The mountains extend for 2,400 kilometers in length and between 150 kilometers in width at the eastern end to 400 kilometers width in the west.”

High altitudes have induced the formation of over 35,000 glaciers within the Himalayas, forming the source of major river systems that flow both north and south into neighboring
countries. The mountains also play a major role in the flow and direction of large-scale monsoon weather systems that regularly impact the region and support the life systems of many diverse ecologies.

Geologically, the Himalayas and their immediate surroundings are sometimes referred to as the ‘Third Pole’ of Planet Earth. The sheer amount of fresh water stored as ice in these high peaks gives them a quality of being like the aggregations so much more familiar to most of us at the North and South Poles. Yet this region suffers frequent large-scale disasters due to earthquakes, avalanches, mudslides, rock falls, floods, and extreme weather events. In addition, the glaciers are in serious retreat due to global warming, and there is a shift in much of the biological makeup of the region due to such warming.

Safeguarding this water supply is a grand challenge for Earth regeneration. The populations of fifteen nations directly depend on the Himalayas—a diversity of peoples who speak dozens of different languages, practice many different world and indigenous religions, operate under very different systems of government, and have a long history of economic interdependence juxtaposed with sporadic military conflict.

Here we are dealing with more than 15 national boundaries and the highest population densities for humans on Earth. The threats of water scarcity move slower than the unraveling of the Amazon and will occur on timeframes of several decades to a century. While many among us are thinking about the rising seas that will flood some of these lands—with the estimated 100 million people who could be displaced in Bangladesh alone—there are many less who are reflecting on what happens when a portion of those 35,000 glaciers start to dry up and many great rivers cease to exist.

Notice how we have leaped into the depths of Gaia consciousness. If trying to do regenerative design for most of South America wasn’t enough to sober us, now we can begin to feel just how daunting our task truly is! Yet somehow the future of humanity must be cared for and nurtured through this bottleneck of population collapse. There are many cultures with profound and deep histories from this other part of the Earth. A great number of our religions—think of Buddhism and Hinduism—emerged in these unique landscapes thousands of years ago.

Yet all that we know of as “great” emerged in the span of the Holocene. They are all remnants of civilizations past or those soon to be gone. How do we safeguard the wisdom that they hold as we learn how to feel into the quiet stirring of new life amidst the vastness of death on scales such as this? And what of the indigenous traditions that are uncountably lost already? How much wisdom has disappeared that would be vital to us now when we ponder challenges on these scales?

I hold this grief in my writing process to share how it reminds me that I still have deep love for the world dying around me. You may feel the same way that I do about this. So how do we envision the management of complexities for a region-of-regions like the Himalayas? Here we again see the functional landscape as organizing principle to lay political and cultural fragments
of humanity over a map carved by the upward thrust of two tectonic continental plates. Can we bear witness and give hospice to the Amazon while actively intervening to hold dear that life which still cycles through this grand mountain range elsewhere on the planet?

Rather than think of what future archaeologists might discover in the ruins of present-day Himalayan landscapes, let us hold in focus what is truly regenerative about them. They are expressions of extreme heat and pressure deep within the Earth. They are capable of pushing entire tectonic plates high into the stratosphere. These generators of vast weather systems move much more slowly than human lifetimes and so their contours can approximately be held as constants for decadal timescales. It is the upward life of moving air that drops so much water down over these towering peaks. And it is their altitude that lets them store so much moisture in solid form as sheets of ice cling to rocky precipices.

Can human beings learn how to feel the sentience of a mountain range? Might they sit long enough in silence to become perceptual fields for the springs gushing forth from water that moves through a landscape as massive as this? Let us continue thinking about Integrated Landscape Management to reflect on what kinds of tools and frameworks can help us do regenerative design at these enormous scales.

Luckily, there are already many maps to work with. We can study the contours of geology and watch videos about the hydrological flows during and between monsoons. The Earth Observing System gives us many ways to see the structures and flows involved. Our task becomes how to care for this ebb-and-flow of life so that those humans whose lineages survive through the die-off can become ancestors of regenerative cultures. Where are forests being nurtured with the planting of native seeds? Who sits in prayer in mountain temples to hold love for the landscapes in which they reside? What are the ancestral life systems that withstood the tests of time in these places?

There are the canal systems and terraced gardens all over the world that humans have constructed to guide the circulation of water as it runs down mountain slopes. During a trip I made to the hill station of Simla in Northern India earlier in my life—a beautiful mountain town that is the point of departure along the Hindi-Tibetan Road only passable during limited parts of the year due to high accumulations of snow—I recall being mesmerized by the stacking of terraces throughout the entire region for growing food in ways that slows the movement of water so that more is retained in the soils within these terraced canals. These structures slow the erosion of soils and stabilize slopes to protect against landslides.

We can also take inspiration from cultural practices where spiritual training gave rise to complex management of water as it flows through landscapes. In nearby Bali, an island along the Indonesian chain, there are the “subaks” that were merely seen as structured waterways by Western economists with their dead mechanical worldviews. When the United Nations initiated a project to rationalize this management system and take it away from the monks who ran the temples throughout the extensive canal system, it quickly began to fail. Within ten years, a system that had thrived for a millennia was in near-total collapse.
All of this happened so quickly that the cultural knowledge had not yet been lost. Many elders still knew how to manage the temples where gift offerings were made from one part of the river to another so that harmony would prevail. Little did the rationalist thinkers recognize that it was the prosocial norms and behaviors—combined with an active meditation about the feelings of the river as a living being—that enabled the monks to manage the river effectively for so long.

Here is an example of indigenous spirituality making a water system function because of the attention and care it cultivates in the humans who seamlessly weave themselves into being part of it. Imagine if such harmony could be restored to the ancient ways of managing river flows across the vastness of the Himalayas. This is a fundamental task for thinking about how the regeneration might occur.

Yes, there should be multi-stakeholder gatherings. They should be empowered to set up their own self-organized management systems. They will need scenario planning tools to set shared agendas and track progress as they move toward their goals. This will involve a lot of data gathering, monitoring and evaluation, and improvisational management for how they participate in the changes as they unfold. Throughout it all there is also a profound need for spiritual maturity for the ethics of sharing, generosity, and gratitude through good times and bad.

They will also need the Blue Marble perspective that links their region to planetary processes. The excesses of material consumption in Western consumer cultures have removed many of the non-renewable resources from other parts of the world—measured as “wealth creation” using instruments like Gross Domestic Product to track their success. This leads to a kind of resource depletion that destabilizes ecosystems and leads them eventually to collapse. For the Southeast Asian part of the world, this pattern is complemented by the sheer biomass of humanity measured in the billions of people packed together in places like India and China.

Another way that ecosystems collapse is when biomass accumulates in one species until the interdependent webs of life become unstable. This inevitably leads to a rapid decline in population numbers for the species involved. We can anticipate something similar to occur in the landscapes surrounding the Himalayas later this century. It will be important to recognize that this too is an expression of regeneration. The processes of destabilization, death and decay, are merely part of the cycling that is recognized in mature relationships to understanding how life and death dance together in all ecosystems on Earth.

One way that the water supply of the Himalayas might be protected is to allow the human population to restabilize at much lower numbers—unpleasant and traumatic though this will be for our own kind. We have a situation with paradoxical conflicts of ethics that really cannot be resolved in a morally consistent way. Thus one of our great challenges will be to again grapple with that important question of Who is “WE” in regenerative design? In this case, it will be those who actively take on design-thinking roles in support of restoring planetary health.
It will be helpful to think like a mountain. The regenerative designers are those who keep and share native seeds; raise children who love being out in nature; walk with humility among the other species in their landscapes; and practice rituals of devotion to the healing of soils. A much-quoted saying by Confucius is this:

*If your plan is for one year plant rice. If your plan is for ten years plant trees. If your plan is for one hundred years educate children.*

With the challenge of safeguarding the Himalayas, it might be helpful to add one more line that says *If your plan is for one thousand years grow a forest.* We need to do all these things—feed ourselves year by year; grow trees that will feed and shelter us when we are old; raise children who will continue serving Gaia well after we are gone; and stabilize ecosystems for the webs of life that will continue flowing long after our children’s children are old.

Note how growing a forest is not the same as planting a tree. It entails working with and co-creating for the vast web of microbes and fungi in soils. There is a pattern of learning to see which migratory animals disperse the seeds so that they are fed early in the process to enhance what emerges later. Design of water catchment and retention systems will shape how it flows into and through these life systems as the ecosystems evolve through various stages of succession. And the “climax” stage is guided to and reached for the forest to become self-stabilizing and self-regenerating without active management by humans.

If enough people learn to do permaculture at this scale, and they locate themselves in enough valleys and slopes throughout the Himalayas, there may yet be a Third Pole of the Earth one thousand years from today.

**Chapter 22 — Heal the Beating Heart of Africa**

As we continue feeling into Gaia consciousness, I would like to return to a story mentioned briefly in the prologue because it has so much more to teach us. Readers are probably old enough to remember all of the widespread hunger and starvation throughout the late 20th Century in Africa that mobilized a planetary-scale movement to bring poverty to an end. Organizations like *Save the Children* and *Oxfam* came into existence to reverse what colonialism had done—in this case for the British Empire from which these NGOs emerged when the hardships of people living in Africa came to light through storytelling and media production in the later part of the 20th Century.

What remains largely unknown is that the plight of these African peoples was exacerbated by planetary-scale linkages that profoundly shaped the stage on which things played out. The scientific consensus is clear that all of humanity originated in the continent of Africa. If there is a deep historical home for our species, this is it. And so we are given the opportunity to return
to our Motherland that birthed us from within Gaia millions of years ago so that our hearts might be healed in these troubling times that we find ourselves in today.

One of the tragic ironies inherent to the climate change discourse is that wealthy people from largely white cultures are the people mobilizing themselves to avoid catastrophes perceived to be in the future. This is tragic in two ways. First, the failure to see how our wealth and success came from inheriting the spoils of conquest has blinded us to the stained blood on the hands of our ancestors. Thus we fail to see our brothers and sisters in the catastrophes that already occurred in the halted lineages of peoples that were wiped out of existence. This has blinded us to how our ancestors built castles of opulence on the death and decay of other human cultures.

Secondly, it is tragic because this perspective blinds itself to the reality of the present where future projections of harm are turned around in time. The catastrophes already occurred for someone else. It happened in another place while we were unaware of what was going on. This lack of true history keeps us from adequately preparing ourselves for the future that is coming for us—in part because we haven’t yet processed the ecological grief from our shared history with conquered lands that gave rise to this unique planetary predicament.

Let me state clearly that there is no such thing as a climate “doomsday.” It is not a singular event that happens in one moment of time. There have already been climate-related collapses of human societies. There will be more in the future. And there are collapses playing out right now in various parts of the world. A powerful reminder of this is the shutdown of the Sahel Monsoon that took place in the 1960’s. Here we again have the pattern of a planetary-scale process being linked to regional-scale changes.

Recall how the deforestation of the Amazon is shutting down the regional-scale hydrological cycles of South America—and tectonic plates that thrust the Himalayas upward are what stabilizes the monsoon rains of Southeast Asia. In the heart of Africa, there was another regional-scale system of weather that created a stable return of water throughout Sub-Saharan Africa. It was the weather system of the Sahel Region that runs in a narrow strip from west to east along the southern border of the great Saharan Desert. This includes the present-day nations of Mauritania, Mali, Niger, Nigeria, Chad and Sudan, while encroaching into other regions farther south and east as well.

Key linkages include the drying out of land to the north of the Sahel, made famous with shifting sand dunes and camel treks across a sweeping vista of desiccation that spans the girth of Africa. This is the vast landscape of the Sahara Desert. Add to this the belt of high and low pressure weather systems called Hadley Cells that continuously produce clouds and rain in the tropics around the entirety of the Earth. What we find is that large air currents pull these weather systems northward and southward around the Sahara, helping to keep its core high and dry.

Now add that in the early 1800’s there was a rapid increase in industrial activities throughout Western Europe. Cities like Berlin, London, and Paris began a process of burning coal to run large machines in their newly constructed factories at this time. A lot of the coal they burned
had sulphur and other minerals in it that would be released into the atmosphere through smokestacks that blotched the sky with black smog. Invisible in this pollution was the fact that sulphate aerosols—the floating molecules of partially burned coal that linger in the stratosphere after being lifted in the rising smoke stream of these factories—have the indirect effect of increasing the lifetime of stratospheric clouds. This *lengthening* of cloud lifetimes is confounded by the more localized *shortening* of cloud lifetimes from the soot itself. Clouds burn off more quickly when there is hot coal ash mixed into them. Yet the sulphate aerosols remain in higher numbers up in the stratosphere where they gradually alter the mixing processes of future clouds downstream as the air moves around the globe.

Why does this matter to the heart of Africa? It is the scale-linking across planetary systems that brings the story into focus. As sulfurous coal burned life into industrial economies of Europe, there grew an abundance of stratospheric clouds with the property of reflecting sunlight back into space. This regional cooling effect altered the formation and trajectories of weather systems in the middle latitudes of Europe to the north of the tropics. It pushed some weather systems southward that displaced and altered the Hadley Cells as they crossed over the northern regions of Africa. Thus through a sequence of unintended and indirect consequences, the monsoon pattern of the Sahel abruptly shut off when this shift in planetary meteorology accumulated to its tipping point—which gradually built up between the 1870’s and 1940’s while the economy of Europe was booming with fossil fuel combustion activities.

The “cause” of the shutdown was distributed in space and time. It spanned the economic development of industrializing Europe and spatially altered the weather systems across two continents—all of this occurring over a roughly 100 year timeframe. The shutdown itself was delayed until around 1960. And the ability to reconstruct this story with scientific rigor and share it through peer-review research didn’t happen until around 2010. This delay in comprehension continues to this day because few are technically trained in the specifics of atmospheric chemistry and the computational modeling of Earth’s climate, resulting in the story being left untold up to the present day.

The droughts that caused crop failures were widespread in a band of Africa spanning west to east. This displaced a diversity of local peoples who came into conflict with each other in their struggles to survive. The starvations and violence that followed arose from this backdrop of human-caused climate change. Care should be taken to recognize that many factors were involved. Yet it is now known to be the case that linkages from one region of the planet to another have had severe destabilizing consequences.

The climate doomsday already occurred for these people with dark skin pigmentation and a diversity of indigenous cultures. Those of us privileged enough to be scared that climate change may harm our cultures *in the future* will need to swallow this bitter medicine and practice humility about who has already suffered from globalized economic activities. Our societies became richer and our technologies advanced—making use of many extracted minerals from these destabilized regions of the world. And now many among us march in protests and strive to balance financial returns with the threat of future climate-induced harms. Yet we are to this
day blind about the fact that marginalized peoples have been inflicted decades ago by that which we fear may eventually come home to roost for us.

This privileged blindness of living in a colonizer culture is a particularly important challenge for ethical discernment. Not only do we need to practice having functional clarity about what is ecologically adaptive in a given context, which is challenging enough when so many people lack the ecoliteracy to know how to participate in healthy ways with their local ecosystems. We also need to decolonize our minds around the spatial and temporal distribution of consequences for what has already transpired during the buildup to planetary collapse and while it is now playing out on the world stage.

The subtleties are what matters here. One of which is the subtlety that the amount of coal being burned during an historical timeframe was relatively small by today’s standards. Exponential increases have ramped it up—alongside the explosion of human population—in the 20th and early 21st Centuries. It was an accumulation of nudges to the weather systems over Western Europe and Northern Africa that destabilized their trajectories on a century-long timescale.

None of this was perceivable at the time because there were not any weather satellites to track the changes across this vast geography. The first weather satellite was launched into orbit in the early 1970’s. Individual human minds could not discern this shifting pattern. Nor could aggregates of data analyzed with rigor by the people managing Census Bureaus and other growing capacities to track demographic changes in human societies throughout the 20th Century—a pattern that was mostly expressed in Western nation-states that was delayed for this regional spread across Africa due to slower rates of institutional development.

It has only become possible to see this particular story of climate disruption because we have gained the capacities for computer simulation and scientific visualization of data outputs that can be checked against real-life empirical data from the satellites and other sensors that were put in place throughout the last 50 years. This means we could not have known that factories in Berlin, London, and Paris had contributed to the genocide and wars of the Sahel region while it was all taking place.

Causation is spread out in space. It is also spread out in time. Even now the people who have access to these perception systems of Earth System modeling are often not the same as the people in different geographies who are being impacted by what gets revealed by their visualized data outputs. The institutional abilities to make sense of these dizzying complexities are not up to task for managing them as they occur. This leads to another subtlety that could really challenge our efforts to regenerate the Earth—which is that the “causes” of destabilization may have already occurred and none of us knows it yet. So we may not be aware of just how blindly we are flying into the future as we seek to manage the changes with design intent.
Yet there is a silver lining in this story. These powerful abilities for perception and sense-making are quite new. They are only one or two generations old when measured in human terms. We are just beginning to learn how to collectively think, feel, and act when informed by planetary perspectives. It has become possible to feel the heartbeat of Africa’s weather systems as they dance interdependently with the drumbeats of economic activities farther north. A key question for us is how to employ these new skills in service to planetary healing.

How might we envision a network of human groups regenerating the heart of Africa when empowered with skills like these? One thing that is now understood is that local weather patterns are linked with “micro climates” in the contours of landscapes. Just as the regional weather of one large area is indirectly coupled with the regional weather of other areas, so too are these localized systems interdependent with each other. This opens up the possibility that an African drum circle of regeneration could scale upward to synchronize and layer its rhythms into larger geographic harmonies.

Another aspect to this is that Africa has become an exemplar of “failed” economic development. While colonial (and post-colonial) extraction has long been the progenitor of impoverishment for people in Africa, it has remained a target of economic conquest to the present day. The drawing of national borders to fence off desirable resources for colonial powers to exploit was a key contributor to the instabilities and conflicts that arose when the Sahel Monsoon shut down.

This aspect of the story matters for reasons we will go into more deeply in the next chapter. For now let us remain focused on the power of linking across scales in space and time to achieve new kinds of resonance. There are two dynamics of regeneration that have kept the healing of Africa from occurring. One is the increasingly sophisticated processes of material extraction that transfer wealth from Africa’s native ecology into the trinkets and gadgets sold in consumer market economies around the world. This is done to fill the coffers of billionaire investors, mafia families, and descendants of aristocratic families. These are the people who employ clandestine tools like tax havens, zones of economic deregulation, supplanting of democratic leaders with puppets for their schemes, and media propaganda to ensure that human trafficking, legal and illegal drugs, weapons, and the more publicly acceptable forms of domination to be preserved.

The other is the colonization of minds through doctrinal education and extensively funded media influence to ensure that the true story of what is happening does not successfully get told. As local communities organize themselves around bioregional regeneration, the subsistence patterns across a historically tribalized continent will begin to reveal themselves as sustainable cultures embodying regenerative principles. They were never backwards or primitive at all. The thing most of us have had backwards is the notion that we have things to teach them. A more accurate account reveals that those who grew up in cultures lacking a sacred connection to land have a lot to learn from those who still hold strongly to these regenerative roots.
Each of us carries within our chest a beating heart from Africa. As we gain the eyes to see larger patterns of interdependence, a chorus might arise to bring the discord in our hearts into resonance with each other. *Ubuntu, my heart beats as yours.* This is true for our bodies. It is true for the land. And it is true for the weather systems weaving landscapes into orchestras of relationships that beckon us to listen with renewed ears.

Imagine as we strive to bring the Amazon back to life, that we also hold space for the Himalayas to anchor stability around another key domain of the world. And we do this by going deep into our human history as African descendants where ancient rhythms can still be found to remind us of who we are.

We regenerate ourselves by learning the true story of humanity. And in doing so we gain a memory of being animated dust moving across the land alongside every other living being the Earth has ever known.

**Chapter 23 — A Cautionary Tale About Entrenchment**

In the last three chapters, we explored the scale and complexity of Earth regeneration for important regions of the world. It probably feels overwhelming to even try holding all of this in mind because we humans did not evolve in ancestral environments that required us to make decisions about such things as interdependencies among ecosystems or planetary-scale linkages altering each other in different places across the Earth.

Yet we are in a position now that requires us to learn how to manage these complexities if we want to survive a future that has become entailed by prior developments. The *carrying capacity for humanity* was exceeded decades ago—as we learned from William Catton in Chapter 17—and we were all born into a time of overshoot that was largely hidden from view. What I want to talk about now is *developmental entrenchment* and how structures that arose in the past will constrain and limit what is possible in the future.

The easiest way to think about development is with the life cycle of an organism. For humans there is a moment when sperm and egg unite and these two cells become one. The unified zygote begins a miraculous dance of diversification as it begins dividing and taking shape according to its genetic code while being shaped by environmental factors in the womb. Early in the process, a central line forms that will eventually become the spinal chord. This introduces a structural support for anchoring globules of cells that grow into the heart and brain. A lateral symmetry has been introduced that will continue through all later developments as arms and legs arise, fingers and toes take shape, and the body grows into its mature form.

It is helpful to think about the spinal chord as a kind of scaffolding. It takes shape early on in the process and becomes a structure on which to build as development continues. This leads to entrenchment. Other kinds of symmetry like the radial pattern of starfish are now excluded by the constraints that already emerged. It is exactly this dynamic unfolding—of structures arising
earlier that limit or constrain (as well as encourage and support) the range of possibilities that get built upon later on. We can see that the Earth as a dynamic evolving system is filled with patterns of developmental entrenchment.

For example, it is no longer possible to keep all fossil fuels in the ground. Many have been dug up and spread around the atmosphere. Their distribution in space and time are now irreversibly altered. There is no realistic way to gather them together and pump them back into the rock strata of the Earth’s crust. The same can be said for copper ore, gold, uranium, and a lot of other materials that are forever re-organized and altered due to human interventions.

The same can be said for the size of the human population and the present dominance of consumer market behaviors across most of our institutions. They arose and took shape; scaffolded self-benefiting constraints; and made deeper transformations impossible so long as those scaffolds persist. One way to see this is in the gradual rise of thinking that green consumerism made by individual choices could somehow bring humanity into an ecological civilization. Change your light bulbs. Buy an electric car. Support the corporate brands that express your values. All of these ideas only make sense when our social worlds have already been captured by consumerism after decades of marketing designed to get us thinking about ourselves in individualistic terms. Note how the values expressed in this cultural dynamic are at best a co-opting of the sacred in service to selling products. Authentic sacred relationships have been replaced by the in-the-moment feeling of satisfaction while making a purchase.

I could give a thousand examples like this and each would reveal that most of the talk about transforming the world is based on a profoundly unrealistic sensibility about the developmental entrenchments involved. The example of green consumerism is educational in this respect, but it only gets at the surface of how deep the structuring of constraints truly are. Let us know talk about Carbon Lock-In and what the fundamental differences are between societies that depend upon fossil fuels and those that don’t. This will help us discern what we cannot directly change in our regeneration efforts so that we can focus the precious energies that we have available to us toward things that can still work.

Carbon Lock-In refers to the developmental entrenchment of a society that made use of fossil fuels to come into being. A foundational research paper titled Carbon Lock-In: Types, Causes, and Policy Implications was published 2016 that explores this at length. The authors identified a set of constraints around carbon-emitting infrastructure, the market systems supported by it, the capture of policymaking by financial elites who benefit from this infrastructure, and cultural behaviors shaped to align with living in a fossil-fuel economy. Just as the human body holds within it an incredible diversity of feedbacks anchored to having a spinal chord that integrate the functions of blood circulation, cognition, muscular movements, and so forth, we can see a similar complexity of interdependent relationships that constrain the future developments of fossil-fuel economies.

These patterns of entrenchment can be seen in cities that were built for the movements of automobiles. Roads and highways provide the basic geometric elements—things like how far it
is along a city block from one street to the next. I recall how different it felt to walk in downtown Seattle where the high-rise buildings grow up from city blocks that are 400 feet long, as contrasted with walking in downtown Vancouver where decades of development had pushed cars away from the center and design was directed toward walkability. Seattle felt inhuman and loud. Cars lined the streets waiting for traffic lights to change. I had to walk quickly and sometimes run the last section of sidewalk to catch the flashing walk signs and get across the street before cars were given priority to move again.

Vancouver, by contrast, has shorter blocks that are 300 feet long. A policy structure had been set in place in the 1970’s that any time a building was torn down and replaced it would not be allowed to put parking lots back in. This contributed to shaping a set of incentives for an excellent public bus system, networks of bike lines, traffic lights set to signal around the walking pace of pedestrians, and greenways for parks to be built. The feeling of walking around downtown was a casual enjoyment of street life and the ease of moving at a natural bodily pace to catch the next traffic signal for pedestrians.

Go a step further and consider walking in a city that was built before the automobile. I also have memories of times when I visited Bologna in Italy—which has a stone wall as a perimeter around the old city center. Within this wall is a circular network of woven streets that connect with each other as winding paths and central courtyards. Arched walkways stretch alongside streets that were built for horse and carriage but now provide echo chambers for cars and their exhaust to crowd out the people walking along under them. Automobiles are an intrusion to this setting and still, thanks to fossil fuels, have become the dominant presence here. Yet when you manage to get into a park or central plaza, the feeling changes dramatically. Fluttering of birds and chattering of humans in conversation begin to fill the air. Something is different about the shape of the space itself that feels more ancient.

Yet all of these scenes are different from walking a stone path high in the Andes across terraces of rock between one village and the next. We continue to move farther away from the feel of fossil-fuel societies as we get into terrains too difficult to force these simpler geometries onto them. There are no straight lines, squares, or circles here. Instead it is the meanderings of stream beds and jutting out of rocks that tell each path where to go. Humans are embedded within the land and cannot force their efficiencies onto it. This difference gets at the heart of developmental entrenchment for fossil fuel societies. When energy is cheaply available, an entire mountain can be punched through to provide transport routes for human goods. But when the energy is not there to be exploited, it is the mountain that dominates and humans must remain humble in its presence.

Urban development has only been possible during the Holocene anyway. It is important to remember this fact as we talk about developmental entrenchment. Many of the societal structures we take for granted would not have been possible without this extended period of stable warm climate. The developmental structures of cities have depended upon the stability of rivers, weather patterns for food production, and transport across the regions surrounding them as they connect to other cities. A great deal of developmental scaffolding has gone into
the formation of empires and civilizations around cities and their circulatory flows. When we go
depth into regenerative thinking, even this becomes open for reconsideration. What if cities are
no longer possible to sustain in any location now that the Holocene is over? Might it be the case
that they were never sustainable? As we learn how to decolonize our minds, topics like this
come to be important to explore.

Due in part to the rise of consumer culture mentioned a few paragraphs ago, the policy
discourse around climate change has myopically focused on carbon dioxide emissions as if
replacing a coal power plant with a wind mill could somehow address the deep structural
mismatch of using 200 million years of stored sunlight in the span of a few centuries. The same
“rational choice” economics described in Chapter 6 for dead economies became the primary
scaffold of policymaking in the environmental arena between the 1960’s and 1990’s. This
entrenched view that consumer purchases made by individuals should be a focus of
ecological behavior change. The incorrect theory of economics gave rise to a flawed view of
human behavior. Yet the entrenchments allowed these flaws to take hold in performance
management, policy evaluation, and financial measurements—each further entrenching our
societal institutions in a paradigm that is poorly matched to reality.

A fully ecological approach would look at land systems change, fossil fuel emissions, loss of
biodiversity, and accumulation of waste across the Earth’s biosphere as an integrated systemic
pattern. Yet what we are left with is reductionistic numbers like 350 parts per million that
organize social movements around extremely myopic policy frameworks. This myopia is why
they fail to see how human population—and the consumption patterns of market-driven
capitalist societies—have already taken us into a place of planetary-scale overshoot and
collapse. The numbers that need to come back down are better focused on population size and
ecological footprints than on CO2 levels themselves. This can be seen in the sobering fact that
CO2 levels have only been observed to go down during economic collapses like the financial
meltdown of 2008.

Here we can see that industrialism rose around the privatization and extraction of resources.
This was given a transformational boost by the use of fossil fuels and oil in particular. War
machines were built in the early 20th Century around transport networks for automobiles that
fundamentally changed how we structure cities, food production, supply chains, and the
electoral processes of representative government. Money came to be a key influencer as
wealth accumulated by burning oil to dig minerals out of mountains. This dug holes deep into
our political consciousness, depriving most of us of a proper ecological education or
experiences of meaningful civic engagement.

What comes out is a developmental entrenchment in existing structures that cannot be
replaced from within. A silver lining is that these structures are dependent upon a stable
climate system and an endless supply of consumerism—both of which are physically impossible
to maintain for very much longer. So this system will self-terminate and collapse. We needn’t
try to change it. Instead our energies are better focused on building up the regenerative
economic models that will arise to replace them as they go down.
Let me give another foundational example of developmental entrenchment that must be addressed if we are to regenerate the Earth. While I was part of an activist collective called /TheRules I learned how to tell the story of poverty creation. It was during this time that I learned how mass poverty came into being. It started with what has come to be called the Enclosure Movement in Britain that arose throughout the 16th and 17th Centuries when previously common land shared among peasant farmers—managed sustainably for centuries—became legally owned by private estates that could charge rent to live upon the land and evict tenants who were unable to pay the going rate.

Thus was born the modern incarnation of Capitalism as a model of society built around private ownership. It coincided with the first land grabs and displacements of local peoples who were forced into conditions of abject poverty. Many of these displaced farmers moved into the city as a pool of cheap labor for the factories whose toils of suffering were made famous in the novels of Charles Dickens. The only reason the factory owners could exploit this workforce for personal gain was because (a) they “owned” the factories; and (b) people were so desperate after being kicked off of common land that dying in a factory was the best option they could find.

Run this history forward in time and you will see a pattern of developmental entrenchment where those with the financial and political means to close off a commons and extract value for personal gain could rig the systems in favor of doing more of the same with each passing generation. Forests were cut down and fences put up. Maps were created with boundaries around private lots. Ecological corridors were severed to make way for whatever activity might be profitable to the owners—with no regard for future generations or any other stakeholders who might be impacted by the commercial activities involved.

This reached a level of engineering marvel when accounting systems were set up around stock exchanges and “public trading” of shares in corporations. Those who controlled the capital could easily move their money around to direct labor pools toward the next extractive activity—always racing to the bottom in terms of environmental and social justice while pushing for the top in quarterly earnings. We ended up with a system of entrenchment that is blind to ecological reality, unable to care about the future, and designed to be morally sociopathic in its endless pursuit of profits no matter what the consequences might be.

A counter-movement has sought to entrench itself against this pattern. Those who see the various commons of land, air, water, fisheries, community, and so forth have set up cooperative ownership models of various kinds. There are community credit unions, cooperative land trusts, public lands set aside for all to enjoy, member-based organizations, and more that seek to undo this extractive system by setting barriers in place that distribute decision-making and protect that which is valued together by groups of people.

There are projects like those of the Commonlands Foundation that seek to coordinate around landscape restoration efforts of entire territories. One of their projects is in the Altiplano region
of Spain where one million hectares of land are being managed around reforestation efforts, creating regenerative agriculture programs, and setting up local market exchanges so that the people living in this degraded landscape can have a good life while healing the land. Or new business models like that of Blacksheep Regenerative Resource Management in Costa Rica that have set up systems of shared ownership where as many as 100 people might collectively own the value developed on one of their agroforestry projects. They invest together, enable long-term planning to emerge, and recognize many kinds of value beyond the narrow of financial return.

What matters here is that developmental entrenchments have shaped our history in profound ways up till the present. We need to understand the structures and constraints, directions and incentives, that arise with the entrenchments of the dominant extractive systems if we are to design and implement their replacements. The capture of institutions over the last 40 years by a specific ideology of wealth hoarding known as Neoliberalism has made it far more difficult to direct them toward planetary regeneration.

It is here that the lesson about death in ecology becomes urgent in a practical sense. We will need to learn how to *guide succession* of human ecologies as this colonizer period of pioneering institutions have now poisoned their environments to such an extent that they are in their death throes. What emerges as they die depends largely on how skilled we get at composting the nutrients and directing them toward the emergence of regenerative economies.

I hope that this chapter helps clarify what cannot change—so that we might know how to direct our energies toward the work that must now be done. We cannot convert a fossil fuel economy based on private property into an “innovation machine” for restoring life to the Earth. Instead we must grieve the loss of life that has already (and will soon) occur. And focus on putting in place the compost systems for redistributing nature’s bounty back into the restoration of landscapes all across the planet.

Chapter 24 — Making Humanity Worth Keeping Around

Throughout this book I have tried to take great care around the ethics of human cultures. We need to understand how they each function in their relationships with larger ecological contexts and then bring our own values to the embodiment of regenerative actions. In Chapter 3 we explored the question *Are you saying humans are bad for the planet?* and I didn’t take a stand at that point in the conversation because we hadn’t built up a shared context yet in which to draw conclusions.

Now I believe we are in a position to do so. The foundational difference between human cultures that we are concerned with here is whether or not they are regenerative in the ways they are embedded in their landscapes. We can reframe the above question to *What does it mean for a human culture to be regenerative?* and see that the answer comes back to that
notion of autopoiesis introduced in Chapter 4. As energy and nutrients flow through the human system, they must create robust patterns of recirculation so that the “conditions conducive to life” are continually replenished. Nothing less will do the job.

In Chapter 19 we introduced the notion of autopoiesis for the entire planet—what is known as the “Gaia Hypothesis” that Earth’s biosphere is self-regulatory in a way that has kept the planet inhabitable across multi-billion year timeframes. And in Chapter 14 we explored the notion of evolutionary transitions capable of giving rise to bioregional economies and their interdependent relationships amongst each other. Together these concepts enable us to see how humans can create the next evolutionary transition for the planet. We are capable of creating a regenerative network of human cultures that actively maintain planetary homeostasis.

Whether this is good or bad depends on two things: (1) How humans relate to the rest of life on Earth; and (2) What we believe the future holds if we do or don’t evolve in this direction. An implication of Earth regeneration as it has been framed throughout this book is that we are trying to create planetary stability similar to what the Holocene naturally was, yet do so with intention and purpose as a collective goal for our species to continue having complex societies with trade networks across diverse geographies. Our answer to the first question will need to grapple with this implication as we take steps in this direction. Let us address it first.

One of our most destructive expressions of hubris has been that humans were deemed special in some way that makes us better than the rest of life on Earth. The technical term for this is Anthropocentrism and it refers to the biased view that humans are placed at the center of everything. It is worth noting that indigenous cultures with sustainable track records were all fundamentally Ecocentric and would describe Anthropocentrism as a kind of cultural immaturity or mental illness. They always placed humans within a web of kinship relationships that held the wellbeing of the entire ecology as the center of their worldviews.

This takes concrete expression for things like agroforestry projects and regenerative farming. Are they merely a more sophisticated expression of industrial thinking that incorporates ecological measures into their accounting systems while keeping humans as the primary recipient of benefits? Or do they treat non-human life as sacred and honor the delicate interdependencies among all who live on the same landscape? How these questions are answered might determine whether or not a portion of the land has been set aside and protected for non-human life. It might also influence whether the land gets sold off (and later degraded) by someone who inherits it in the future. Or it might influence how “pests” and “weeds” are conceptualized in the context of management goals.

The creation of Sacred Contracts has come up in conversations I’ve had among fellow regenerative designers who work on legal frameworks for land projects. Three women—Cassandra Ferrera, Jennifer Menke, and Zoë Wild—have each worked with indigenous communities and participated in the formation of community land trusts. What they have found is that there are specific rituals and community practices that enable people who
steward a piece of land to develop sacred relationships with it. And they have identified a suite of legal tools that can be used to protect the land as this feeling of sanctity grows.

For example, there might be an elder landowner with several children who wants to set aside some of the land to be protected. Yet this person knows that their children depend upon the inheritance they will gain by having the land passed down to them. What they might do is explore adding a deed restriction or placing an easement on the land that limits what their children and future generations can do with it. Or they might feel comfortable gifting a portion of the land to a community land trust while taking care to hold some of it back for their family. These kinds of decisions can be very complex and highly political within the immediate relationships of those involved. This makes it even more important to have facilitation processes and support tools that reveal what is already sacred and help extend this to the land itself.

As we zoom into this localized context we can see how the feelings of Ecocentrism are what give expression to the way relationships are managed. There might be exactly the same permaculture practices for building a forest canopy in the regeneration effort. Yet how those involved feel about their stewarding roles will have a profound influence on their actions. What might be done to invest in land improvements will be shaped by the legal constraints that provide the necessary developmental entrenchments to move toward longer-term regeneration goals. Where we are living in Colombia, for example, it is going to be necessary that a large territory be reforested. This will span many private lots of land and require coordinated investments of time, energy, and materials that serve this landscape-scale goal. If no legal protections are developed for the land among our collaborators, we will not be able to trust that they remain cooperative in the future. It is here that Sacred Contracts can be brought into the social learning process and help those involved to recognize the benefits of cooperative ownership models.

All of this is related to the question of human goodness because we have learned in cultural evolutionary studies that a commons can only be managed well if it meets all of the necessary criteria—what Elinor Ostrom called the core design principles that we explored together in Chapter 10. There is no way to safeguard our regenerative projects at small scales if we fail to cultivate the larger systems of cooperation that function at landscape, bioregional, and planetary scales. This deep alignment of ethics with action is especially important when we seek to achieve coherence across many scales while working on regional and planetary aspects of the regenerative work.

Let us now begin to deal with the second question. What is likely to happen in the future if humans don’t anchor ourselves to regenerative practices and continue existing as part of the Earth? Would our extinction be bad for the planet as a whole? This relates to what I mentioned above about the Holocene in a subtle-yet-significant way we will come back to in a moment. For now, I want to explore how our failure to do our very best at Earth regeneration now could spiral things into a realm that does harm far beyond our own species.
An unstated assumption of most sustainability work—that I suspect is never made conscious by most who work in this space—is that our attempts to “sustain” cities and globalized civilization have mostly been captured by the presumed normalcy of the Holocene itself. Ten thousand years of climate stability made it seem normal. So one can be forgiven if they treat it as a benchmark for sustaining human cultures. Forgive, but recognize that the viewpoint may ultimately be empirically incorrect.

Do you remember back in Chapter 2 when I talked about the work of William Ruddiman? He was the earth scientist studying orbital parameters of the Earth and Sun that explain why ice ages occurred for the last few million years. It was his theory about slow-motion climate change caused by human activities that suggests we may have brought an end to what I called the “Age of Ice Ages” when we kept the planet from reverting back to an ice age several thousand years ago. The evidence has been accumulating in favor of this conclusion for about 30 years now. And if he turns out to be correct we have a challenging ethical dilemma that will be hard to wrap our heads around. Did humans bring about an end to the Holocene? Yes. But did we ALSO bring an end to several million years of erratic climate behavior measured on hundred-thousand year timescales? That is seeming to be the case.

It is important now because of things like the “Hothouse Earth” scenario developed by a collaboration among earth systems scientists at the Stockholm Resilience Centre. It is one expression of what might happen if we fail to set in motion the regeneration of vital planetary patterns that restore planetary feedbacks which enabled the Holocene to have stability in the last ten thousand years. Hothouse Earth refers to a sequence of abrupt and highly nonlinear shifts in the climate system. These shifts being so rapid and intense that the earth system as a whole jumps onto a new trajectory that leads to a full Mass Extinction Event. Imagine 90% or more of all living species being wiped out in a few hundred years—starting in roughly 1850 and running forward beyond the present. This would wipe out humans and we have no way of knowing how long it would take for the Earth to “recover”—in part because it would never come back to the way it is today anyway and the estimates for how long it takes for species to evolve range from hundreds of thousands to tens of millions of years.

It may well be the case that the only way to avoid this extreme outcome is to save ourselves while bringing regenerative capacities back to the biosphere at a planetary scale. We don’t yet know if it is possible to create the kind of stability that gave us this precious Holocene period. But we must acknowledge that our actions in the next few decades will largely determine how far the planetary collapse goes. And so we have an urgent moral call to save ourselves—if indeed we love our own species—and to minimize the future harm of runaway cultural evolution as it continues intensifying at this midway point of civilization collapse for our globalized economy.

When we consider what might happen in the future if we don’t take regenerative action now, it becomes evident that we will ethically fail ourselves as the generation alive today if we cannot say we did our very best. On our death beds, if we are each so lucky to die on one surrounded by the people we love, we will be left to reckon with our consciences about what we did or
didn’t do in this unprecedented moment in time. We still have the chance to be ethical in service to the Earth—and ironically, it is by seeing our human uniqueness due to several thousand years of flawed Anthropocentrism that enables us to consciously embody an Ecocentric perspective in the midst of this great unraveling.

Throughout the book, we have glimpsed many of the tools and frameworks that could enable us to regenerate the Earth. We have Prosocial for creating functional teams. Blue Marble and developmental evaluation to manage complexities while guiding ourselves toward collective goals. Integrated Landscape Management for restoring ecological health and community resilience at territorial scales. An Earth Observing System for monitoring changes at all levels. And Regenerative Economics principles to assess the models we create to move forward in every bioregion around the globe.

Let us carry these ethical quandaries with us knowing they have not been resolved. We make the path by walking it. And judge ourselves by the moral standard for what we each consider to be sacred. That will have to be enough because at the end of the day that is all we’ve got to go by anyway. Yet we can continue bolstered with the knowledge that all sustainable human cultures in history were able to manage themselves by making their sacred relationships central to our livelihoods. It worked for them. And it may well work for us too.

Chapter 25 — What the Design Pathway Might Look Like

Imagine you are at a sustainability conference surrounded by professionals who earn their livings helping others become more environmentally helpful. There is to be a talk that someone gives about how they have created the framework for regenerating the Earth. Sitting in the audience at a big conference center in one of the globalized cities of the world, you feel a disconnect between what your body is doing and the ideas flowing in the story being told from the stage. Afterwards you get up during the coffee break to go find a bathroom and maybe run into one of your friends in the lobby for a quick chat—but there are only 20 minutes before the next round of presentations begins and you don’t want to miss the first speaker because they really inspire you a lot.

Let me say for the record that what I just described is not what the design pathway might look like. All of the entrenched structures of globalization are present in that conference hall. People flew in airplanes to get there. Most of the talks are structured around fundraising goals and programmatic outcomes for the organizations represented by their speakers. A profound disconnect exists between the developmental dynamics of organizations in a fossil-fuel economy and the evolutionary patterns of coherence needed to bring about Earth regeneration.

We have to reframe in our minds what the pathway is for Earth regeneration. It is a journey inward to go deep within ourselves and discover our true history—then seek the alignment of
our personal actions with the healing of local landscapes at nested levels of relationships. If you were to walk into a garden filled with flowering plants, there might be bees buzzing among them gathering pollen to take back to their hives and make honey. Everything about the life of the bee is coherent with its surroundings. The bee constructs its home with local materials. It participates in food production by supporting the wellbeing of the plants it depends upon for survival while pollinating the reproductive cycles of germination with its sharing of pollen from one flower to the next.

Yet when we look at our own lives most of us will see profound incoherence because the social niches we live within are dynamically narcissistic. Most of us go to work so that the company that pays us can survive in order to give us a paycheck. There is a structural coupling of social action to social environment but an absence of structural coupling from social action to larger ecological context. Biologists who study adaptation call this an evolutionary mismatch. It is when a functional relationship to some past environment was beneficial for survival. Then the environment changes and the function remains but is no longer helpful—and it can even do harm.

We humans evolved an incredible capacity to live within our social niches of shared language, tool use, and models of organization for our communities. These became inheritable patterns of relationships within our cultures and they altered the structures of our environments so that we inherited those changes too. Most of us alive today are only here because an industrial civilization came into being that dug up fossil fuels and cut down native forests so that landscapes could be converted into human activities that serve financial goals. It will require spiritual practice to take this in and hold it authentically. Even I, the author writing to you now, am a converted fossil fuel deposit living and breathing because landscapes were destroyed to provide for my survival.

Walking the path of Earth regeneration will look like people waking up to these depths of ecological reality. Knowing that the destruction of habitats for non-human species has occurred because the social niches we were born into require that they be destroyed—all so that we can participate in the global economy. A shift is required deep within ourselves to feel our kinship with the rest of life on this planet. Millions of us are already awakened and seeking alternative livelihoods that bring this pattern to an end. So what might the design pathway really look like?

At the heart of it all is evolutionary coherence. We learn how to see the functional relationships in our social niches as they relate to the material flows of nutrients and energy across the landscapes in which we live. This is something that can be seen, felt, and experienced in the routines of our daily lives. Just like the bee that has all material flows of its livelihood embedded in place, we too can actively create social niches that enact this for our local economies. But what is that like? Let me paint a picture using tools we have available for daily use in the extractive economy that can be envisioned differently in regenerative contexts.

Banks are typical institutions of the modern era. What might they look like when walking the design pathway of Earth regeneration? A grounding metaphor (quite literally) is to think of Land
as the Bank. It is the foundational asset on which to build a local economy. Without land there is no place on which to build your home, no place to grow food, no place to provide habitats for nonhuman species, and so forth. The organizing principle of functional landscapes becomes embodied in the flows of value created in the land itself. Water needs to be stored? That’s what aquifers and reservoirs do. Health needs to be maintained? The key is healthy soils and environments devoid of toxins. Food needs to be grown? Intact ecosystems provide all that is needed.

Imagine that in early 2020—while a real pandemic has been hitting the world and locking people into their homes for multiple months to slow the spread of a deadly virus—a group of Earth Regenerators create a special model of cooperation. They call it the Earth Regeneration Fund and it is structured as a portfolio of land-based regenerative projects. Each piece of land has natural capital in its rocks and soils, flow and storage of water, and habitats for species. A valuation system is set up to track the flow of value across each landscape, aggregating it for the entire portfolio of projects. When “improvements” are made like new trees get planted or a water retention system gets installed, the value of the land goes up. Similarly, if the humans living on these lands get trained in permaculture or gain skill at growing healthy foods, the value of the land goes up as well.

Now think about the collection of land-based projects as a bank. The bank is not owned by anyone because it has been set up as a community land trust. Everyone who contributes to improving the land in any of these locations will know that the land will never be sold on a speculative market. A governing board is set up to oversee each land trust and align around shared regenerative goals. This creates a situation where the Earth Regeneration Fund operates like a combination of municipal government, credit union, employer, housing provider, and educator. Different kinds of value are tracked using 21st Century ledger systems (for those who are familiar, this is the realm of cryptocurrencies, blockchains, etc.) for social capital, information and learning, natural capital, infrastructure, and the health of the system as a whole.

Add one more element. The Earth Regeneration Fund is a fractal of nested levels. There is a local portfolio structured around land-based regeneration projects in every bioregion on Earth. Local governing boards manage each piece of land within the portfolio as its own community land trust. Coordination of territorial regeneration projects for watersheds and other larger landscape features is done by a bioregional learning center whose mission is to manage that place. And the entire planetary system is aggregated across these bioregional learning centers to hold the learnings and share them from one bioregion to another. This creates clarity for what the design pathway to regenerate the entire planet could look like.

Let us imagine that there are 500 bioregions on Earth. The number might vary from a few hundred to a thousand or so in reality, so this number is meant to be representative of something plausibly manageable. Each bioregion sets up a Bioregional Investment Platform and manages it as a Bioregional Learning Center. This is where each land-based cooperative is documented and knowledge gets aggregated for multi-stakeholder collaborations at the scale
of each territory. Digital infrastructure built around the Earth Observing System enables each of these bioregional collaboratives to share information across a planetary network. And so the regeneration of landscapes in the Sacred Valley of Peru has its own investment platform and learning center. Yet it is able to learn from and help improve the parallel efforts east of the Andes in a sub-basin of the Amazon River located in Brazil.

Extrapolate this thinking to every region on Earth and it becomes possible to see how micro-scale coherence can emerge for families and communities. This becomes interwoven with bioregional-scale coherence for the platform hubs. And it is able to self-organize around planetary restoration goals to achieve Earth System Coherence with things like the Planetary Boundaries framework and related tools.

For my family living in Barichara, Colombia the local scale would be the plateau on which the town rests with a drainage basis for the Barichara River and its fifteen tributaries. We would need to create mapping tools for this territory and build what local campesinos call “mercados de solidaridad” (solidarity markets) for farmers to grow food that serves local households. The houses are already built from clay and rock using earthen construction techniques. Baskets, paper, and textiles can be grown and hand-made using local plants and craft skills of people living here. Each element of the economics for families in their homes is part of the tapestry of these solidarity exchanges. And at the foundation of it all is cooperative management of land.

You can live into this design pathway by searching out the incoherences in your life system and making changes that bring you into closer alignment with the ecological realities of the landscape you live within. Help identify who the people and organizations are that already structure their work around regenerative economics for your bioregion. Find out if there are community land trusts already in existence. Talk with people at your local credit union about setting up a community fund among its members with regenerative landscape goals. And practice simplicity by growing some of your own food, participating in local craft markets (as an artisan as well as by being a client), and aligning your living situation with energy and material flows within local capacity.

Imagine how you might invest money that you have in one of these regenerative land projects. Or that instead of going to college you get trained in a local craft center or study permaculture to work on a local land initiative. Maybe you are a technologist building the communication platforms, data analysis and visualization tools, or simply helping improve whatever design systems people are working on in your community. You could also be an elder who plays with the kids and teaches the history of your place while parents are engaging in these other activities nearby. The key to all of this is to think like a seed. It cannot grow without a nourishing womb—which is the land itself. And all that becomes possible for its thriving emerges through the robust circulation of water, nutrients, sunlight, and structured supports in the ecosystem where it was planted.

The same is true for human cultures. We can each live in beautiful places that we treat as sacred, learning how to live in harmony with the rest of life in coherent ways. And if we
structure this livelihood around cooperation, landscape restoration, and Earth System monitoring, we can become the Gaia Hypothesis in action. This really is possible. And now is the time to do it. There is no more left to waste.

Chapter 26 — A Regenerated Earth

It is time to bring this book to an end. It really only has one purpose that was the opening statement in the Preface:

This is a book about what will need to happen if humanity is to intentionally avoid extinction. It is a disturbing truth that our current trajectory includes the real possibility that we could fail to meet this objective—and as a result bring about our own demise.

If you read all the way from there to here, all I can say is thank you. Gaia has called us into alignment because we have work to do. While writing these chapters I created an online study group called Earth Regenerators to host discussions and offer webinars about the content presented here. To my amazement the study group took off. At this moment we have nearly 1200 members and the eighth webinar will be held this afternoon—about how to create nested platforms that achieve the evolutionary coherence described in Chapter 25.

This is shared to say that we don’t have to worry about this book “creating the action” by itself. That is already happening and has been developing for decades among countless related efforts. My hope in writing this has merely been to share the clarity I have gained for what the patterns of development might be to enable the design pathway to emerge.

Let us close with a visioning process for the future. Imagine the Earth regenerated. What does it look like? How does it make you feel? Are you surprised to discover that you already knew how to imagine it? We have taken this journey together to prepare ourselves for what lies ahead. There will be a period of turbulence with unavoidable loss. In truth, much that is sacred has already been lost. Yet hope remains for those of us able to think like geologists and behave like gardeners.

The Bible tells us that the meek shall inherit the Earth. And that everything is ashes to ashes, dust to dust. These truths were passed down culturally from the previous Hebrew Tradition which has ancestral roots in the indigenous peoples of the Middle East. If you look at the Koran you will see that all references to Heaven are depictions of clean rivers, healthy forests, and intact ecosystems. Here again we can see that the image of a Regenerated Earth go way back in time. Similarly, the first written story—the Tale of Gilgamesh—reminds us that we anger the gods of the forest to our peril. Cut down the trees to feed narcissism in your city walls and disaster awaits you for the imbalances you create.
This is what is so fascinating about the need for a book like this to be written in the first place. We have always known what a healthy planet is, yet our social niches from civilizational modes of existence have erased our indigenous roots and washed away our history of the sacred in specific places on Earth. We must now find Home again. It is the Earth, of course, but also something more specific. My wife grew up in the suburbs of Chicago and I was a child in Missouri. Yet we are creating home in a tropical dry forest of the Colombian Andes because that is where Gaia has called us to service. Where will your home be?

A Regenerated Earth has habitats for all its living creatures. Every human nested into its atmospheric blanket has a bed to sleep in. And so do the lives of the extend family in the species our survival depends upon. We learn how to care for the bacteria and garden the mushrooms, because they are the ones who grow the plants. And we learn how to honor the sacred relationships among all our Gaian neighbors so that we too might be blessed with a healthy life.

I close by asking you to put this book down and find a quiet place in nature. Sit alone with yourself and do this meditation:

I call into awareness the Earth that anchors my body to this place where I now sit.

A breath inward of nourishment. A breath outward of gratitude.

I call into awareness the Sky that elevates my being to flow with all that is alive.

A breath inward for strength. A breath outward for service.

Thank you, Gaia. You are me. I am you. Together we are WE.

Sit with this meditation any time you feel like you’ve lost connection with the Great Spirit of Gaia. Be present to your existence as a sacred role to play in a great orchestra of collaboration. The Earth is far from equilibrium because there is life flowing throughout its body. It is only out of harmony because we forgot that we were already home. Let us not forget anymore.

It is time. Go out and bless your life by regenerating a little piece of Gaia.

Onward, fellow humans.
May 9th, 2020
(Mother’s Day)