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Earth for All

Five Extraordinary Turnarounds for Global Equity on a Healthy Planet

This is a book about our future—the collective future of humanity this century, to be precise. Civilization is at a unique moment, a juncture. Pandemics, wildfires, and wars swirl around us as we write, sure signs that societies remain extremely vulnerable to shocks despite unprecedented progress. Beyond the immediate turbulence, we are in the midst of a planetary emergency of our own making. What this book will argue is that the long-term potential of humanity depends upon civilization—a wondrous, freewheeling, kaleidoscopic, inspiring, confounding civilization—undergoing nothing short of five extraordinary turnarounds within the coming decades.

We know the pain points. Everyone knows we must end extreme poverty for billions. Everyone knows we must fix the inequality crisis. Everyone knows we need an energy revolution. Everyone knows our industrial diets are killing us, and the way we farm food is ripping through nature, driving a sixth mass extinction of species. We know human populations cannot increase endlessly. And we know our material footprint cannot expand infinitely on our finite, blue and green Earth.

Can "we"—meaning all people and peoples—come together to navigate this century? Can we take a collective leap in human development with courage and conviction? Can we overcome divisions, neocolonial and financial exploitation, historic inequalities, and deep, deep distrust among nations to deal with the long-term emergency? Can we achieve *systemic transformation in decades, not centuries*?

Our goal with *Earth for All* is to show you that this is indeed fully possible. And that it won't cost the Earth. Rather, it is an investment

in our future. Based on expert assessments supported by system dynamics models, the pages ahead explore the most likely routes to emerge from these emergencies; the pathways that bring the most humanitarian, social, environmental, and economic benefits to all.

Earth for All is about valuing our future. Most people value their personal future. But what about valuing our collective future? As a civilization, as eight billion people, as an entangled web of societies? Well, the evidence that we do is very limited. The COVID-19 pandemic is certainly a prime example of this failure. Despite enormous wealth in some countries, we simply did not put in place basic safeguards to protect civilization from a threat that was known, highly likely, and entirely avoidable. The investment in adequate preparation was, essentially, peanuts compared with the global suffering to date.

Another sign of chronic failure: Millions of children have had to walk out of schools around the globe and march in the streets to get our attention. The school strikers' message is simple: "Our house is on fire." Those with power, they say, are taking colossal risks with their future, consigning them to live on a destabilized Earth. The placards on the streets read "Systems Change, Not Climate Change" and "Listen to the Science." And the youth carrying them are demanding, rightly, a fair and just transition of societies. Now.

Their plea exposes some uncomfortable questions. Why are actions to prevent pandemics or climate disruptions so shockingly inadequate? Are economic systems driving industrial societies in a direction that's impossible to change? Is it even possible for everyone, whether eight or ten billion people on Earth, to prosper within planetary boundaries? Is societal collapse inevitable? Or can we find a way to value and invest in our collective future here on Earth?

This book tackles that last question head on. It presents the findings of the Earth for All initiative, which began in 2020. As the pandemic ripped through societies, an international team of scientists, economists, and multidisciplinary experts joined together to analyze what is necessary to build a fairer, more resilient economic system to weather current interconnected crises and future storms. We debated. We frequently disagreed. Some of our disagreements spilled

over into heated arguments. Even with heartfelt commitment to end poverty and neocolonialism and address inequality in all societies, the perspectives between academics and authors in Europe and North America and those from Asia and Africa turn out to be quite different. For example, even though there is full agreement that a food system turnaround is essential, it was tricky navigating how much emphasis to place on organic farming, lab-based alternatives to meats, and the role of man-made chemicals during the necessary transition.

Our analysis focused on two deeply intertwined systems: people and planet, or more explicitly the global economy and Earth's life support system. It is grounded in systems thinking, a branch of science that has exploded in the last five decades and whose tools help us understand complexity, feedback loops, and exponential impacts. Systems thinkers are always on the lookout for leverage points where a small change in one thing can make a big difference to the whole system.

At the heart of the analysis are two intellectual engines that allowed us to explore the boldest economic proposals: the Transformational Economics Commission—an international group of leading economic thinkers—and a system dynamics model we call Earth4All. Through a series of feedback loops, economic ideas from the commission could be tested by the Earth4All model to see if the proposals would have a big enough effect on people and planet over time. Likewise, the commission could critique and challenge the outputs from the Earth4All model.

All of this gave us a robust process to study possible alternative future worlds. We could explore what may happen this century given a wide set of assumptions about human behavior, future technological development, economic growth, and food production—and how all of this affects the biosphere and climate. We got a glimpse of what could happen if the gap between rich and poor widens or shrinks, if greenhouse gas emissions rise or fall, if population explodes or drops, if material consumption mushrooms or is reined in, or if investment in public infrastructure and technological innovations can prevent catastrophe. While analyzing various future scenarios, the role of the

model was primarily to keep our thinking straight. It helped ensure that our scenarios were internally consistent and actually followed from the assumptions we made.

Two novelties included in the model are the Social Tension Index and the Average Wellbeing Index. These allowed us to estimate whether policies—for example, related to income redistribution—might cause social tensions in societies to rise or fall. We believe that if social tensions rise too far, societies may enter a vicious cycle where declining trust causes political destabilization, economies stagnate, and wellbeing declines. In that situation, governments will struggle to deal with rolling shocks let alone long-term existential challenges like pandemic risk, climate change, or ecological collapse.

The Earth4All model operates at a global scale, which is useful for exploring big-picture long-term trends. But this can mask important regional differences. For example, global trends showing strong economic growth may hide economic stagnation in some areas. With this in mind, we developed the model further to track ten regions of the world.[1] This allows us a glimpse of how our scenarios play out in low-income countries of sub-Saharan Africa and South Asia compared with high-income countries of Europe and the United States. Of course, with any additional complexity in any model, this creates additional uncertainties so we interpret results cautiously.

Breakdown or Breakthrough?

Of all scenarios we could describe in some detail, in this book we have chosen two, which we call *Too Little Too Late* and *Giant Leap*. Too Little Too Late asks, What if the economic system driving the world (and now the biosphere) continues operating largely as it has done over the past fifty years? Will current trends in reducing poverty, rapid technological innovation, and energy transformation be enough to avoid societal collapses or Earth system shocks? Giant Leap asks, What if the economic system is transformed through extraordinary efforts to build a more resilient civilization? It explores what it may take to eliminate poverty, create trust, and provide a stable global economic system that delivers higher wellbeing to the majority. Our two scenarios are built from expert assessment and the existing academic

literature, and are kept internally consistent by the Earth4All model. When we combine these, we arrive at the following conclusions.

First, on current political and economic paths, we expect continuing rising inequality by design. We also expect slow economic development in low-income countries, causing enduring poverty. As a result of inequalities within countries, social tensions are likely to rise toward the middle of the twenty-first century.

Second, these factors are likely to contribute to inadequate responses to the climate and ecological emergency. Global average temperature is likely to significantly exceed 2°C, the limit stipulated in the Paris Agreement on Climate, and established by science as a red line it would be deeply unwise to cross.[2] Large populations will increasingly face extreme heat waves, megadroughts leading to frequent crop failures, torrential rain, and rising sea levels. The world risks regional societal instabilities as a result of rising social tensions this century with global impacts. Significant parts of the Earth system are more likely than today to cross more irreversible or abrupt tipping points. This is likely to further exacerbate social tensions and conflicts. The impacts of crossing climate and ecological tipping points are likely to last centuries to millennia.

Third, five extraordinary turnarounds are needed to substantially reduce risks:

1. ending **poverty**
2. addressing gross **inequality**
3. **empowering** women
4. making our **food** system healthy for people and ecosystems
5. transitioning to clean **energy**

These extraordinary turnarounds are designed as policy road maps that will work for the majority of people. They are not an attempt to create some impossible-to-reach utopia; instead, they are an essential foundation for a resilient civilization under extraordinary pressure. And, what's more, there is sufficient knowledge, funds, and technologies in the world to implement them. These five turnarounds are not particularly new. The various actions that drive them have been described separately in many reports. But what we have attempted

through Earth4All is to connect them up in one dynamic system, to assess if *together* they create sufficient economic momentum to push the global economy off the destructive course it is on and onto a resilient path.

We cannot claim this is the precise blueprint for a safe, just future. But we do claim *nothing less than focused, large-scale investment* in these five areas, starting now, is necessary. Why? Well, "just" addressing the climate emergency requires reconfiguring the global energy system—the foundation of all economies—in a single generation. Many of the engineering solutions such as solar panels, wind turbines, batteries, and electric vehicles are here already and scaling exponentially. But the solutions must be acceptable, fair, and affordable to the global middle classes or risk deep resistance. If the energy transformation already underway perpetuates historic injustices, it will have a destabilizing effect on societies. The Earth for All turnarounds show how, with a systemic approach, success might be achieved.

This brings us to the fourth conclusion. The extra investment needed to build a more resilient civilization is likely to be small: in the order of 2% to 4% of global income per year for sustainable energy security and food security.[3] But this investment is highly unlikely to emerge through market forces alone. These extraordinary turnarounds require reshaping of markets and long-term thinking. Only governments, supported by citizens, can provide this. So, the clear conclusion is that governments need to become much more active. The investments will be highest during the first decades after implementation starts, and then decline.

The fifth conclusion: Income redistribution is not negotiable. Long-term economic inequality combined with short-term economic crises (this is the current modus operandi of most large economies) contributes to economic anxiety, distrust, and political dysfunction. These are important risk factors for destructive polarization in democratic societies, which leads to rising social tensions. Because the current dominant economic model will lead to greater income inequality, extraordinary interventions are needed to address that inequality so that we can respond to global existential threats.

We propose a series of policies to ensure the wealthiest 10% take no more than 40% of national incomes. This is far from full income equality in some impossible utopia, but we estimate this is a minimum for functional democratic societies. When gross inequality corrodes trust, it becomes more difficult for democratic societies to make collective, long-term decisions that cut emissions, safeguard forests, protect freshwater, and stabilize global temperature at what scientists estimate is a relatively safe level (1.5°C). Failing to do this will in turn commit the world to even more extreme heat waves, crop failures, and food price shocks. It will worsen inequalities, erode trust further, and test governability to the limit.

Sixth, these extraordinary turnarounds can be achieved by 2050, within a single generation. But action needs to start now. Our future will be vastly more peaceful, more prosperous, and more secure if we do everything in our power to stabilize Earth this decade than if we do not. Without urgent action, we can expect rising social tensions that will make it more difficult to solve civilizational challenges in future.

Seventh, these extraordinary turnarounds will be disruptive. There is no getting away from it. The turnarounds will interact with ongoing disruptive trends, for example the next phase of the exponential technological breakthroughs. Exponential technology promises revolutions in artificial intelligence, robotics, connectivity, and biotechnology bringing economic, health, and wellbeing benefits but with massive implications for privacy, security, and the future of employment. We need to establish social safety nets during this transformation to protect all in society. This is why we have proposed Citizens Funds to distribute a "universal basic dividend" as a keystone policy innovation to address inequality and protect populations from inevitable economic disruptions. Like a traditional "fee and dividend" policy, a Citizens Fund has two parts: The private sector is charged for extracting and using resources that should be seen as under the stewardship of all in society, including fossil fuels, land, freshwater, the ocean, minerals, the atmosphere, and even data and knowledge. The fees are put into national Citizens Funds, and this revenue is then distributed back to all citizens in a country equally through a universal basic dividend (UBD).

And our final conclusion is that, despite these warnings, it is possible, desirable, and even essential to be *optimistic* about our collective future. Our analysis indicates it's fully doable. The window is still open to achieve the Earth for All vision: human wellbeing within planetary boundaries. A concerted effort to redistribute wealth can build trust within nations and between nations, opening up the space to make long-term decisions to reduce risk of existential challenges like climate disruptions or future pandemics. Rapid economic development following these five extraordinary turnarounds could remove absolute poverty by 2050. A rapid shift away from today's fossil fuels and wasteful food chains has the potential to bring long-term energy and food security to all societies. Millions of people currently enduring horrific air pollution in overcrowded cities will be able to breathe clean air again as economies transform. And a clean energy revolution driven by exponential technologies and systemic efficiencies can enable low-income countries to satisfy material needs while avoiding the historic mistakes of the rich nations. Through these extraordinary turnarounds we value our future.

The analysis clearly shows the next decade must see the fastest economic transformation in history. The scale of that transformation may seem daunting.

It is bigger than the Marshall Plan—the economic investments that rebuilt Europe after two world wars.

It is bigger than the Green Revolution in the 1950s and 60s that industrialized farming in Asia and Africa and helped eradicate famine.

It is bigger than the anticolonial movements that led to independent nations in the mid-twentieth century.

It is bigger than the civil rights movements in the 1960s that brought more equal rights to marginalized groups in the United States, Europe, and elsewhere.

It is bigger than the moon landings that cost ~2% of US gross domestic product (GDP) in the 1960s.

It is bigger than the Chinese economic miracle of the last thirty years that lifted 800 million out of poverty.

It's all of these rolled into one. On steroids. Our challenge with this book is to convince you it can be done.

It will require building the broadest coalition the world has ever seen. And it will need to happen as economic power shifts away from the old dominant West in the coming decades toward what we call in this book "Most of the World." Across regions we need an engaged majority on board: both the political left and right, the centrists and greens, nationalists and globalists, managers and workers, businesses and society, voters and politicians, teachers and students, rebels and traditionalists, grandparents and teenagers. It will require rewiring the global economic system. In particular, we need to rethink economic growth, so that economies that need to grow can grow and economies that are overconsuming can develop new operating systems.

It will require rethinking consumption of materials, which may double by 2060 without the extraordinary turnarounds.

It will require redesigning the global financial system from one that is crowdfunding catastrophe to one that crowdfunds long-term prosperity. One priority is redesigning the flow of money in the world. This means upgrading institutions like the International Monetary Fund and the World Bank to make the flow benefit those in poverty, not just the top 10%.

And, it will require more efficient, smarter, and more entrepreneurial states that look out over the horizon and put the safety of their citizens first. Governments must actively support innovation, redesign markets, and redistribute wealth.[4] So, governments need to wake up. The first duty of a state, after all, is to protect citizens from harm. In this volatile century, this means thinking in terms of systems, acting globally, and investing before it becomes profitable, in order to increase the wellbeing of future generations.

A Brief History of Future Scenarios

Earth for All builds on decades of economic and Earth system research. Let's spin the clock back fifty years. People were increasingly concerned about population growth, pollution, and the state of the planet. Rachel Carson's book *Silent Spring* published a decade earlier had triggered a real and serious fear that humans could destroy living conditions on Earth. Recognizing this, the United Nations

convened the first Earth Summit—the UN Conference on the Human Environment in Stockholm. In advance of this summit, a group of young researchers based at the Massachusetts Institute of Technology (MIT) published a remarkable book, *The Limits to Growth*.[5]

The Limits to Growth warned about the possibility—even likelihood—of ecological overshoot and societal collapse. If humanity kept pursuing economic growth and exponential consumption without regard for finite natural resources or environmental costs, the authors warned, global society would overshoot Earth's physical limits and experience sharp declines in available food and energy along with rising pollution, an ensuing decline in standards of living, and ultimately a dramatic fall in the human population, within the first half of the twenty-first century. The book became an unlikely bestseller, with millions of copies sold worldwide.

The Limits to Growth analysis was based on a then-new computer model, World3. Computer power in the early seventies was severely limited by today's standards. But nevertheless, the MIT team created the first computer model that sought to capture the complex global dynamics of human societies evolving on a finite planet.

The team used World3 to explore future scenarios related to population growth, fertility, mortality, industrial output, food, and pollution at a grand scale. The model captured some of the complexity between, for example, the impact of population growth on food availability given that food production can't keep expanding indefinitely. Since then, other computer models have been developed to explore complex global challenges. The results presented here use the same techniques as World3. Indeed, our central model, Earth4All, was designed by Jorgen Randers, one of the four authors of *The Limits to Growth*.

Some of the scenarios explored in *The Limits to Growth* ended in collapse due to rising pollution, food production falling, and a dramatic decline in population. But not all scenarios followed this course. The team also identified a set of assumptions that produced "stabilized world" scenarios. In those, human welfare grew and remained high; key actions could be taken to avoid collapse. The media and other commentators largely ignored these scenarios, instead focusing

on the threat of collapse if growth followed the traditional trajectory. Decision-makers ignored them, too, opting to remain complacent, follow neoliberal economic theory, and pursue growth at all costs—despite the warnings *The Limits to Growth* issued about the long-term effects of business as usual.

So, fifty years on, what do we make of *The Limits to Growth* scenarios? Did they align with reality in any shape or form?

What we can say with half a century of hindsight is that World3 is not just one of the most famous but also a surprisingly accurate global assessment model. In 2012, Australian physicist Graham Turner plotted real-world data from 1970 to 2000 against *The Limits to Growth* Business-as-Usual scenario. He found that the team's scenario tracked closely with reality. An updated look in 2014 showed the same.[6]

In 2021, Dutch researcher Gaya Herrington, a member of Earth for All's Transformational Economics Commission, decided to see if the data were still tracking today. She compared data gained in the last four decades with four scenarios from the latest version of World3.[7] One of these old scenarios assumed the world does little to change course, continuing on an economic and political business-as-usual course (BAU in figure 1.1). An updated version of the original BAU scenario assumed twice as much natural resources like fossil fuels (BAU2). A third scenario assumed massive, comprehensive technology innovation (CT) to solve some of the problems encountered when approaching global limits, like food availability. And the fourth scenario explored a route to stabilize the world (SW) by shifting priorities away from growth in material consumption and instead investing in health and education, reducing pollution, and using resources more efficiently.

Herrington's study is a reminder that *The Limits to Growth* was intended to explore several paths toward different possible long-term futures, not to make one prediction. She found that the first three scenarios most accurately tracked the actual data. This tells us two things. First, as Herrington put it, "The close alignment of empirical data with the scenarios is a testament to the accuracy of World3." And second, this close alignment between model and reality should set off alarm bells. The first two scenarios pointed toward collapse in the

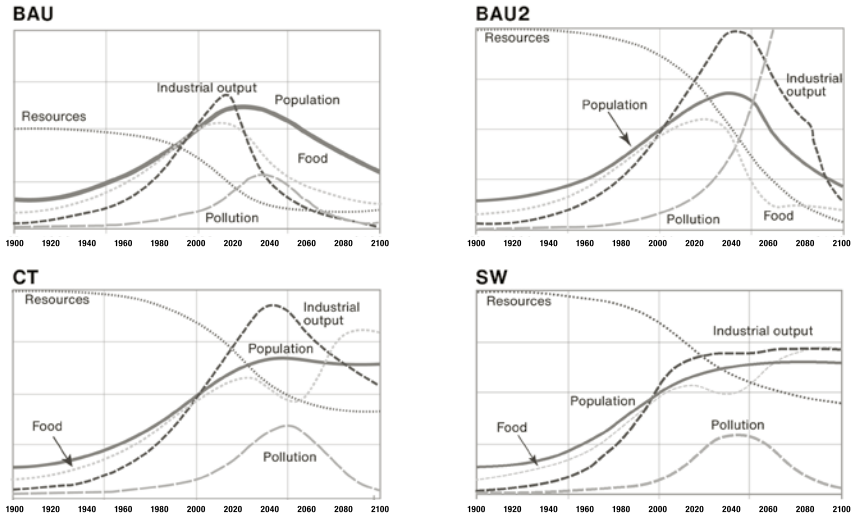


Figure 1.1. Four scenarios from *The Limits to Growth*: BAU, BAU2, CT, and SW. Graphs by Hillary Moore.

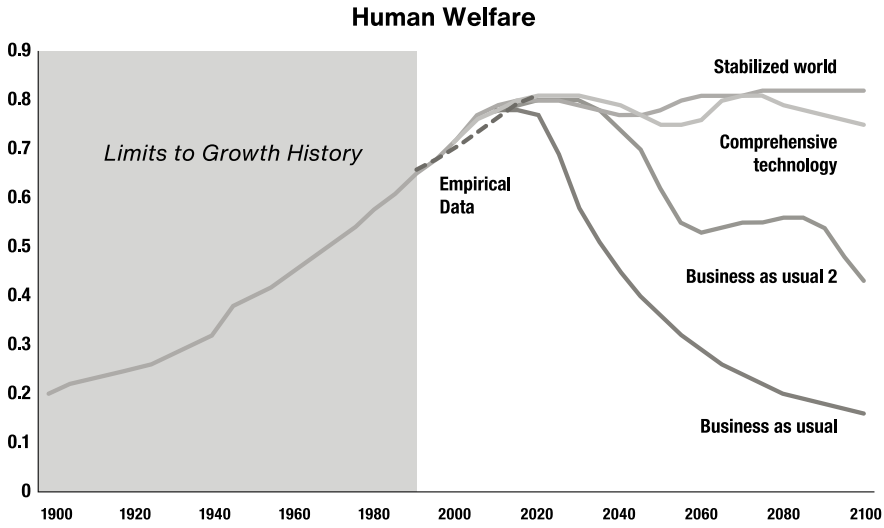


Figure 1.2. *The Limits to Growth* scenarios vs historical data from the UN Human Development Index up to 2020 plotted against human welfare variables for all four scenarios. Credit: Gaya Herrington (2021).

twenty-first century. BAU showed a world whose material consumption crashed up against planetary boundaries. When resources were doubled in BAU2, inefficient overuse continued for longer, ultimately leading to the biggest collapse due to excessive pollution. The scenario relying on technological innovation led to serious declines in resources and industrial output but not collapse. Only the fourth scenario—a large-scale transformation of societies—led to widespread increases in human welfare and population stabilization.

Love it or hate it, *The Limits to Growth* report sparked international debate about civilization, capitalism, fair resource use, and our collective future that continued many years after publication. Ronald Reagan famously attempted to discredit the report by stating: "There are no great limits to growth because there are no limits of human intelligence, imagination, and wonder."

Reagan may well be correct about limitless human imagination, but that does not change the fact that we live on a physically finite, crowded planet undergoing profound changes. It is time to start using that intelligence, imagination, and wonder to reimagine and build equitable societies where citizens can thrive and have freedom to follow their dreams within the planetary boundaries of our one and only Earth.

From *The Limits to Growth* to Planetary Boundaries

Since the publication of *The Limits to Growth* in 1972, one scientific conclusion has eclipsed all other scientific insights in the last fifty years. Earth has entered a new geological epoch: the Anthropocene.[8] This paradigm shift in our understanding of both civilization and the Earth system is as profound as Copernicus's conclusion that Earth orbits the sun or Darwin's theory of natural selection.

Geologists split deep time into units: the Jurassic, the Cretaceous, the Carboniferous, and so on. These mark out the major shifts in our planet's evolution. In 2000, Paul Crutzen, a Nobel laureate on the committee of the International Geosphere-Biosphere Programme, proposed that Earth has entered a new geological epoch, the Anthropocene.[9] This idea quickly gained momentum among the research community. By recognizing the Anthropocene, scientists

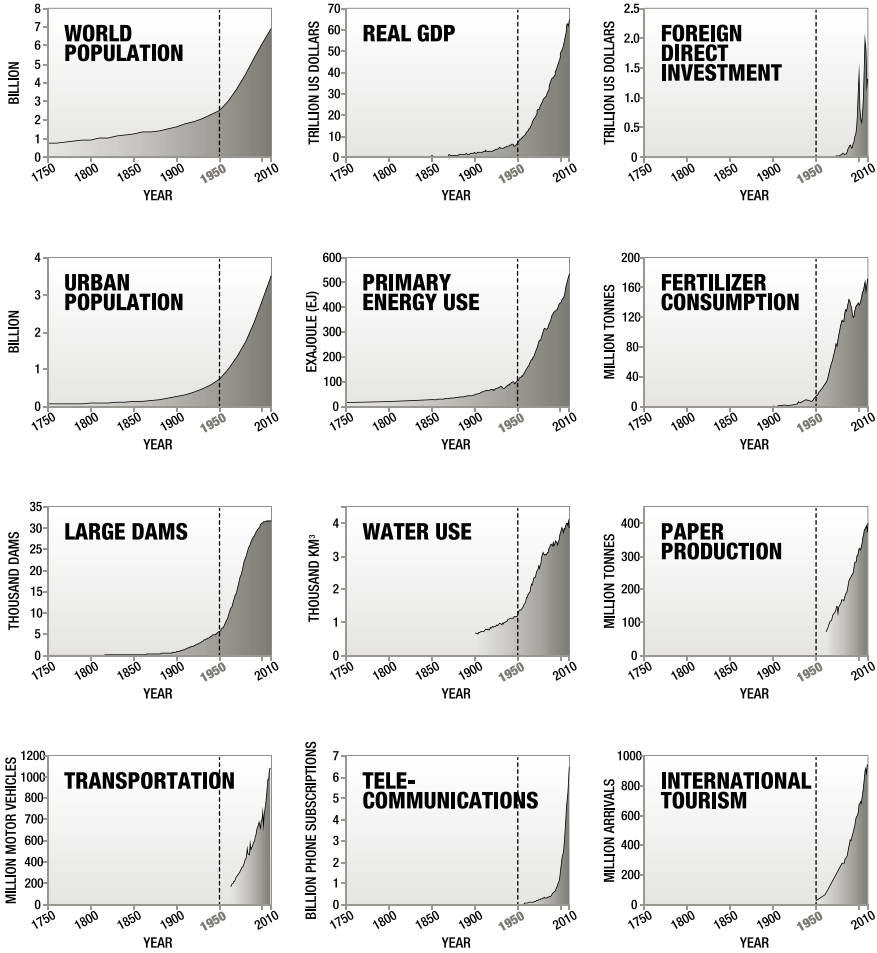
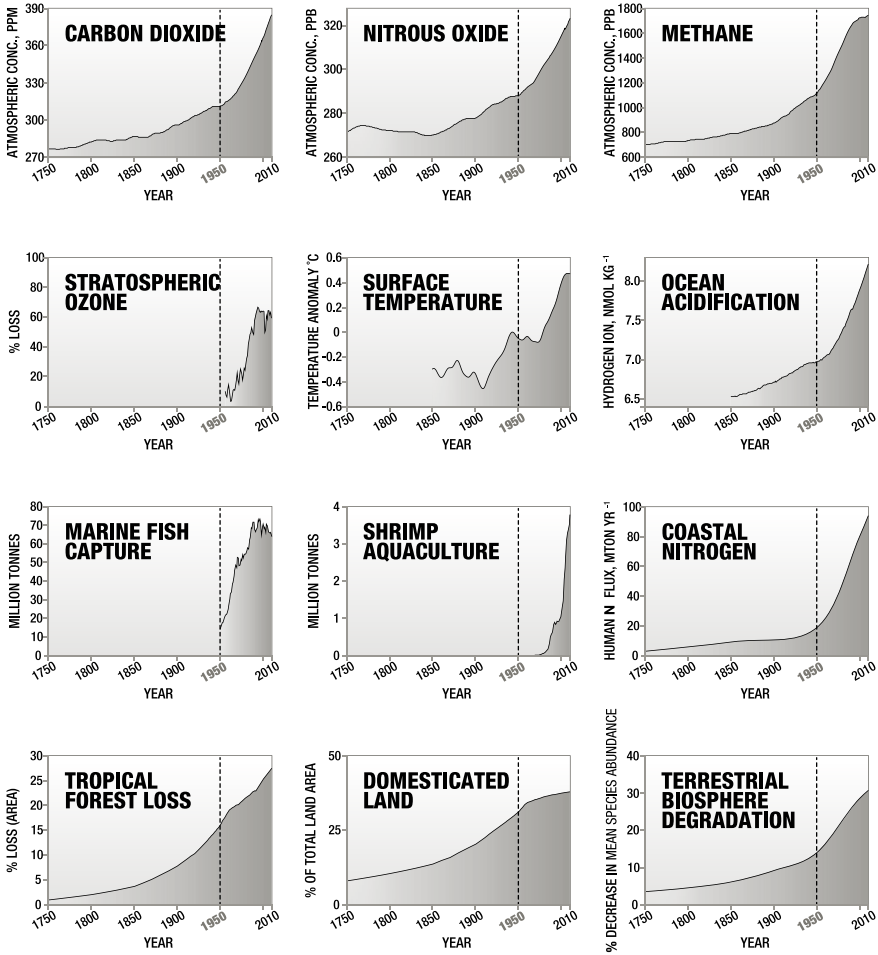


Figure 1.3. The Industrial Revolution (*left-hand panel of graphs*) began in 1750. But the destabilizing impact of the revolution on the Earth system (*right-hand panel of graphs*) only becomes apparent beyond 1950. This pattern has become known as the Great Acceleration. This delineates the Holocene from the Anthropocene. Source: Steffen et al. (2015).

acknowledge that the dominant driver of change within the Earth system is now a single species: Homo sapiens, us. Without doubt, what has happened to our planet in recent decades is absolutely unique in its 4.5 billion-year history.

The epoch we left behind, the Holocene, served human civilizations well. It began 11,700 years ago at the end of the last Ice Age. After



a few bumps, the climate settled into a remarkably stable rhythm. It is no coincidence that civilization emerged almost immediately. This mild climate and relative stability allowed agriculture (and the production of surplus). It has lasted 10,000 years and could have been expected to last a further 50,000 years.[10] But this is now in jeopardy. The growth of industrialized societies, largely since the 1950s, has pushed Earth out of the Holocene boundary conditions. We are in unknown territory. The explosive growth and its direct effect on Earth's life support system is best illustrated by the Great Acceleration graphs (figure 1.3).[11]

As the scientific understanding of the Anthropocene has grown, researchers have become concerned about potential tipping points on Earth—very large climate or ecological changes that are either abrupt or irreversible or both. This concern has led some to explore the conditions that keep Earth in a system state similar to the Holocene. This is worth some emphasis. The Holocene is the only state we know that will support a large civilization. In 2009, a team of researchers published a new framework identifying nine planetary boundaries that should not be exceeded if Earth is to stay within this stable state. In 2015, scientists concluded that human actions have breached the boundaries for climate, biodiversity, forests, and biogeochemical cycles (largely our use of fertilizers using nitrogen and phosphorus). In 2022, scientists announced a fifth boundary has been crossed: chemical pollution including plastics (see figure 1.4).[12] As we write, in May 2022, experts are exploring whether a sixth has been transgressed, too: a proposed new category of freshwater known as green water, the moisture held in soil around the roots of plants.[13]

The tipping point risk is now acute. Indeed, in 2019, scientists announced that an alarming number of tipping "elements"—places we know there are grave risks—are now getting "active." The Amazon rainforest is losing carbon at unprecedented rates. Critical parts of the West Antarctic Ice Sheet are showing signs of destabilization. The permafrost in Siberia and northern Canada is thawing. Coral reefs are dying. And Arctic sea ice in summer is on a downward spiral.[14] Tipping points are not some future risk later this century. We cannot rule out that Earth has recently already crossed several tipping points.

For these reasons, we can categorically define our current situation as a planetary emergency. To use a Titanic comparison, if sixty seconds remain before colliding with an iceberg and it takes sixty seconds or more to turn enough to avoid collision, this can obviously be described as an emergency situation. It is touch-and-go whether there is enough time to act. The alarms should be ringing. For our own civilization here on Earth it will at best take one generation to sail away from dangerous tipping points into a safe zone. The extraordinary turnaround must start now.

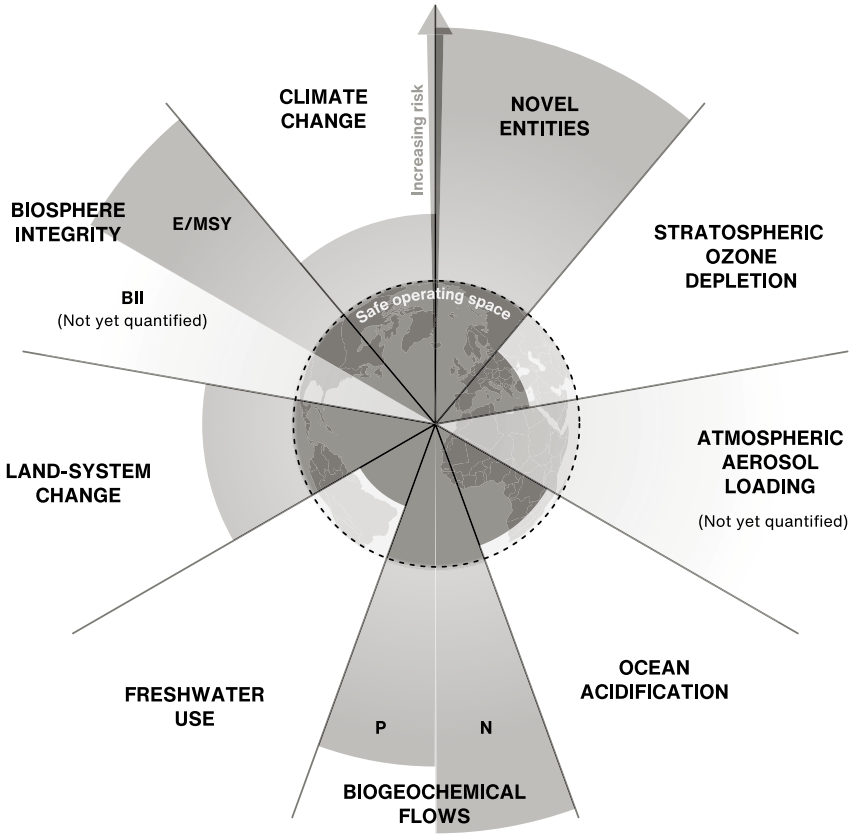


Figure 1.4. The planetary boundaries framework depicting nine boundaries that determine the state of the planet. The central area represents a "safe operating space for humanity," which provides a good chance of ensuring that Earth remains within Holocene-like conditions. Outside this area, there are profound uncertainties about how the Earth system operates. The risk of crossing abrupt or irreversible tipping points, for example, rises as Earth goes further beyond boundaries. In 2015, the planetary boundaries research team assessed that four boundaries had been transgressed. In 2022, another research team assessed the novel entities boundary, which includes plastic and other chemical pollutants, for the first time. The team proposed that this boundary, too, has been transgressed. Credit: Azote, Stockholm Resilience Centre.

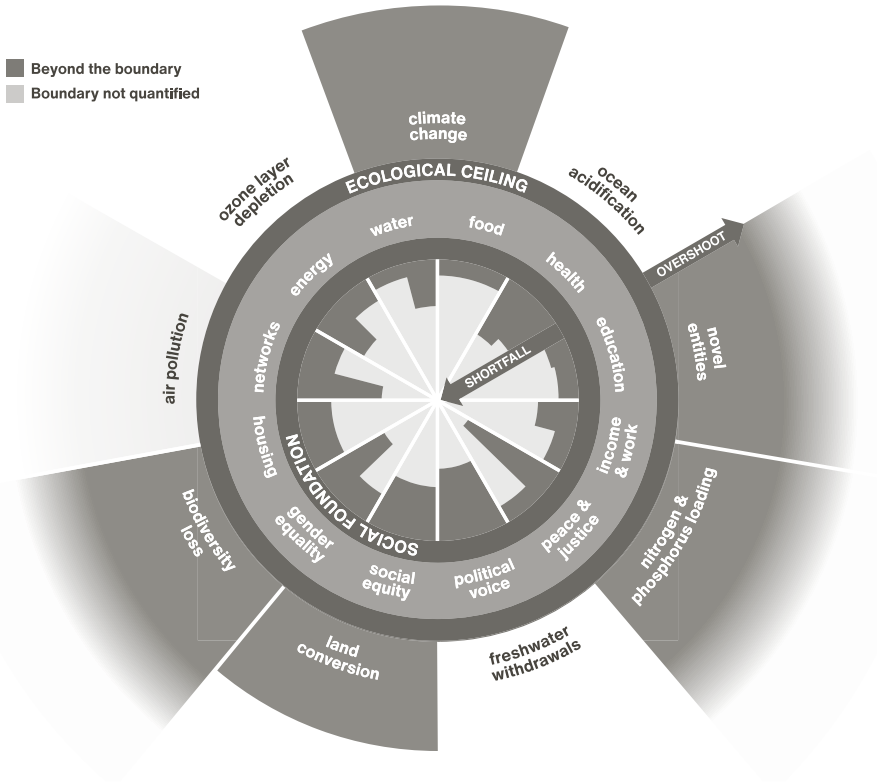


Figure 1.5. The "doughnut" of social and planetary boundaries. We have crossed five planetary boundaries, and many around the world live outside of the social boundaries. The goal is to bring humanity back into its safe operating space, represented here by the area between the ecological ceiling and the social foundation. Source: adapted from Raworth (2017).

The planetary boundaries framework has helped catalyze new thinking about risk and inspired many research groups to explore the implications for policy and economic growth. UK-based economist and Earth for All Transformational Economics Commissioner Kate Raworth took the framework and added twelve *social boundaries*—minimum standards for essentials like access to water, food, healthcare, housing, energy, and education. The doughnut-shaped graphic in figure 1.5 depicts both the planetary and social boundaries and defines a safe operating space for the human economy—"living in the doughnut," the area in which human activity does not overshoot Earth's ecological ceiling and humanity does not fall beneath the

social foundation.[15] Within this space, economies focused on well-being can flourish. Far too many people around the world live below the social threshold, risking the social tipping points we will explore in chapters 3 and 4.

The Earth for All Initiative

While The Limits to Growth, the planetary boundaries and the doughnut are the scientific starting points for Earth for All, the closest things the world has to an agreed vision for civilization are the seventeen Sustainable Development Goals (SDGs) announced by the United Nations in 2015. All countries have agreed to try to meet these goals, ranging from ending poverty to energy for all, by 2030.

But some pretty big questions remain unanswered though. Are the SDGs even achievable? What will it take to achieve them? And looking beyond 2030, what are the pathways likely to deliver long-term prosperity for all on a stable planet?

The Earth for All initiative was created to build a network of scientists, economists, and thought leaders to look at these questions and explore the most plausible pathways to meet the SDGs, and beyond toward a safe operating space for humanity, toward wellbeing economies, toward life in the doughnut. The analysis provides, we hope, some useful guidance on what the priorities are, how much we need to invest, and what fundamental changes our societies and economies must embrace to increase the likelihood of success this century. In that sense, we hope *Earth for All*, the book, is a twenty-first-century survival guide for a civilization on a finite planet.

However, we must acknowledge we certainly don't have all the answers, nor can anyone predict the future. Other networks and research groups are fortunately also working on these same challenges. Looking across at their work, we can see there is broad convergence on the required urgent transformations. This gives us confidence that we are on the right track. Still, we will highlight where there is (and will always be) disagreement among experts and continued tensions that make our path forward difficult.

We developed the Earth4All model to help explore and illustrate scenarios. You will read more about the two most important scenarios

in chapter 2. Each describes a plausible future. Too Little Too Late assumes societies make decisions and respond to future challenges the same way they have in the past—through incremental policy improvements. Giant Leap assumes societies recognize the shared interlinked crises and immediately start changing course through extraordinary actions in five key areas.

Our foresight analysis for this century strongly indicates that the Giant Leap's five extraordinary turnarounds can be achieved by implementing key policy goals.

- **Poverty.** Low-income countries should adopt new rapid economic growth models that secure wellbeing for the most vulnerable. A starting point is reform of the international financial system to de-risk and revolutionize investment in low-income countries. *Key policy goals: GDP growth rate of at least 5% per year for low-income countries until GDP is greater than $15,000 per person per year; the introduction of new indicators for wellbeing.*[16]
- **Inequality.** Shocking levels of income inequality must be addressed. This can be achieved through progressive taxation and wealth taxes, empowering workers, and dividends from a Citizens Fund. *Key policy goal: The wealthiest 10% take less than 40% of national incomes.*
- **Empowerment of women.** Transforming gender power imbalances requires empowering women and investing in education and health for all. *Key policy goal: Gender equity that will contribute to stabilization of global population below nine billion by 2050.*
- **Food.** To transform agriculture, diets, food access, and food waste; by 2050 the food system must become regenerative (storing vast volumes of carbon in soils, roots, and trunks) and nature positive. Local food production should be incentivized, and excess inputs of fertilizers and other chemicals significantly reduced. *Key policy goals: Healthy diets for all while protecting soils and ecosystems and not expanding the amount of land, overall, devoted to agriculture; dramatically reducing food waste.*
- **Energy.** We must transform energy systems to increase efficiency, accelerate the rollout of wind and solar electricity, halve emis-

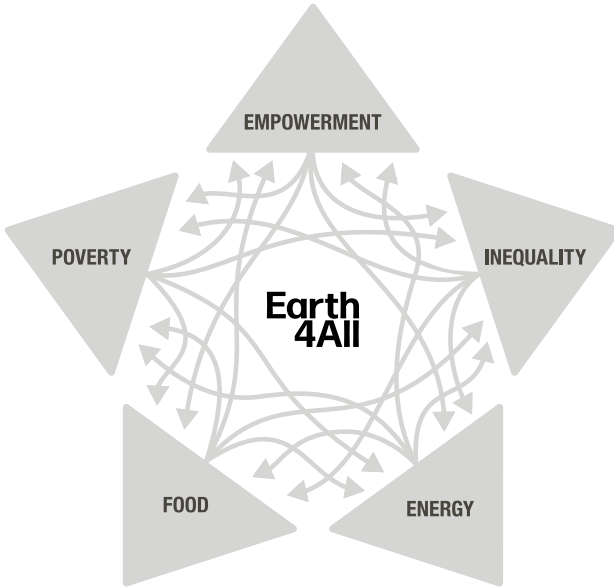


Figure 1.6. The five turnarounds are interlinked so that together they create a whole system transformation.

sions of greenhouse gases every decade, and provide clean energy to those without. This will also deliver energy security. *Key policy goal: Halve emissions approximately every decade to reach net-zero emissions by 2050.*

We called these five main solutions "extraordinary turnarounds" because they break with the trends of the past in significant ways and hold the potential to bring about real systems change. In a way, these turnarounds might form the basis of a new social contract for functioning democracies in the Anthropocene.

Chapters 3 to 7 describe in detail what these extraordinary turnarounds involve and how they can be accomplished. As you will see, they are deeply, systemically interlinked: energy influences food, and both food and energy impact the larger economic system. Removing poverty entails redistribution of wealth, which creates trust and accelerates wellbeing. And empowering women creates economic

opportunity, reduces family size and inequality, and promotes healthier relationships in all societies. As Dr. Mamphela Ramphele, Club of Rome co-president and Earth for All Transformational Economics Commissioner, reminds us, "The essence of being human is to be interconnected and interdependent."[17]

For sure, implementing these extraordinary turnarounds is a daunting challenge in a world of deep complexity. But, from termite colonies to starlings sweeping through the sky, from weather prediction to the global economy, we know that seemingly unfathomable complexity can arise from a small number of simple rules or relationships.

We list three of the most powerful socioeconomic levers for each turnaround in figure 1.7. At the bottom of the pyramids are what we consider the basic policy changes within the current economic paradigm, but then move upward to the bolder policies that really define a new economic paradigm fit for the Anthropocene. At the top of the pyramids are the levers that really deliver the transformation to a new

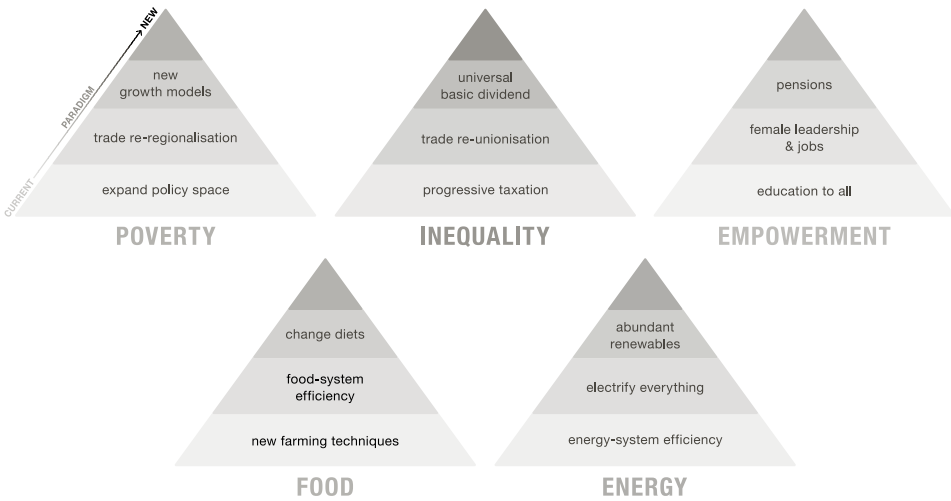


Figure 1.7. The Earth4All paradigm shift illustrated as five triangles. Each turnaround has key levers that will drive a disproportionate impact. Reading from the bottom of each, we begin with the economic solutions within the current paradigm. At the top are the proposals that really are a Giant Leap. They move us into a new paradigm.

economic paradigm, which some have called "wellbeing economics." Here you find some of the big ideas that lock in Earth for All: It is only when we pull these bold levers in the Earth4All model—early and strongly—that we see accelerated transformation toward a sufficiently fair, just, and safe world by the middle of this century.

You—yes, you—can explore other scenarios and solutions with the Earth4All model, and we encourage you to do so. It is available as a simple online tool. See appendix 1 for instructions.

You may have noticed that a number of issues are not explicitly the subject of their own extraordinary turnaround. Where is governance? Surely this needs an overhaul. Where is health? Or exponential technologies like automation and artificial intelligence? What happens in these domains will of course alter humanity's future on Earth. These issues are common threads woven into our scenarios. If you want detail, read more about these issues in the accompanying Deep Dive papers from the Transformational Economics Commission.

You may also have noticed that we haven't given material consumption its own turnaround. Instead, this, too, is a common thread through all the turnarounds, as it must be, because the scale is eye watering. Since 1970, natural resource extraction has tripled. In 2020, Earth crossed a grim threshold: the weight of concrete, steel, plastic, and all other materials produced by humans surpassed the weight of all living biomass on the planet.[18] Today, with almost eight billion people on Earth, we produce 530 kilograms of cement and 240 kilograms of steel per person per year.[19] After clean water, concrete is the second most consumed product on Earth. It is no surprise then that production of steel, iron, and cement accounts for some 14% of carbon dioxide emissions globally.

Demand is growing. But it does not have to. Whatever future we build, it will require materials. If we value our future on a stable planet, then we simply have to do more with less. Ultimately, governments need to incentivize a rapid transition to circular economies. Small changes to building codes could shrink demand for steel and cement by around 25%. Steel and aluminum are already two of the most recycled materials on the planet, but where we must use new

materials, we can change the production system. Using hydrogen, instead of coal, to produce steel, for example, cuts emissions an incredible 97%.[20]

But there are important issues around fairness when it comes to consumption. Consumption is not evenly spread around the world. The twenty wealthiest countries use over 70% of these resources. And the fastest-rising source of greenhouse gas emissions worldwide—by far—are the richest 1% of societies. Overconsumption is a *systemic* challenge: economies optimize consumption at the expense of social cohesion and human and planetary health. Here we tackle consumption head-on. Each turnaround aims to reduce unfair and unnecessary material footprints. Some of this is tackled through progressive taxation, in other places, a Citizens Fund can help reduce unsustainable consumption, and redistribute wealth more fairly. By essentially reducing the material consumption of the wealthiest in societies, and by adopting smarter ways to provide what people really need, we can make more room for Most of the World to have their fair share of resources.

Consumption and a country's gross domestic product (GDP) are linked. Over the last couple of generations, after World War II, GDP has evolved into becoming the preferred way to determine the health of an economy. This is despite the fact that it does not measure health or wellbeing. GDP is simply a measure of the total activity level in the economy, measured in dollars per year. It is nothing but the total output of goods and services produced in a year, multiplied by the price per unit of output. In poor economies, with low labor productivity, rising output initially leads to higher wellbeing. But above a certain income, this no longer holds true. Many studies show wellbeing plateaus as GDP grows. While, yes, people can buy things, they have to contend with clogged arteries from poor diets, clogged cities with SUV-infested streets, and clogged lungs from air pollution. At this stage, rational government policies would shift focus away from growth and rather seek increased wellbeing for the majority.

Generally, political leaders should be agnostic about growth. It really depends on what is growing. Low-income countries need to

grow their economies—especially since this can be done sustainably. And if we succeed in solving the energy and food challenges, this will lead to GDP growth—and this time, this type of growth will lead to higher wellbeing in the long run. So instead of a myopic focus on the last month's figure for GDP growth, political leaders and their voters should ask: Is the economy optimized to improve the lives of the majority? Is the system perceived as reasonably fair? Is the economic growth *responsible growth*? Few countries could answer yes to these questions. And people know it.

People Support Economic Systems Change

What we are proposing will require unprecedented economic shifts in a single generation—actually, within a single decade. Are citizens ready to change? Beyond the protesters on the street catching media headlines, is there a widespread mood for broader systems change in societies? Are citizens aware of the scale of the risks we face in future? And do people want to act? Are they ready for a new economic system that truly values wellbeing for everyone? That is, a truly equitable future?

We conducted a global survey (G20 countries[21]) to find out (see chapter 9). The results show overwhelming public support for policymakers to deliver systemic economic changes necessary for building a nature-positive, zero emissions, and equitable future for all. The findings should provide leaders with the bottom-up public backing to implement policies in line with Earth for All goals much faster.

Momentum is building for change. As we slide deeper into the twenty-first century, people everywhere have been impacted by frequent economic crises, pandemics, wars, floods, fires, and heat waves. But too many people see no viable way to achieve economic security. Even in the richest societies the world has ever known, many feel economically insecure, left behind, or constantly worried about being left behind. And in the poorest countries, they watch rich nations pulling up the drawbridge around the fortress: "No entry." The 2008 global financial crisis so blatantly showed that banking profits are in private hands, but the public is expected to pick up the cost of the losses. The

conventional growth model seems as bankrupt as the conventional economics of efficiency and austerity. No coherent solutions are currently in sight.

We wrote *Earth for All* to provide a fresh, credible, consistent story of how to transform the global socioeconomic system during the next fifty years based on scientific knowledge and illustrated using quantitative system dynamic modeling. The results were reviewed by the multidisciplinary experts from across the globe in the Transformational Economics Commission, and weaknesses identified and discussed. We are not presenting an exhaustive list of solutions. Rather, these are some of the ideas that, in our opinion, could have the most leverage in the shortest time. We hope they spark debate. And we invite better ideas!

In *Earth for All* we present an aspirational, stubbornly optimistic guide to the future. But how likely are we to get there? That, dear reader, depends on what you do next.