1

Approaching Environmental Violence

> A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise.
>
> *Aldo Leopold,* A Sand County Almanac

> Only within the moment of time represented by the present century has one species – man – acquired significant power to alter the nature of the world.
>
> *Rachel Carson,* Silent Spring

1.1 Introduction

Every day of our lives, we humans consume resources to meet our needs. The resources we consume vary greatly, from the oxygen we breathe, to the food we eat, to the energy required to turn on our lights – for those of us lucky enough to have them. Whether we wake up and start a small fire for cooking, or turn on the coffee machine, we all transform resources from one state of matter into another, often emitting a complex of toxic and nontoxic pollutants in the process.[1] For nearly all human beings, the production of hazardous pollutants is part of everyday life.

More problematic than the reality of pollutant production is the amount, or degree, of that production. As Aldo Leopold (1: vii) has said, when it comes to the magnitude of human impacts in an ecosystem, "[t]he whole conflict thus boils down to a question of degree." By "conflict" he meant the tension between the survival pressures faced by human beings and the effects that answering these pressures has on nature. And the question of degree refers to how much we are willing to cause changes in our ecosystem to meet our needs. And, importantly, how much we consume beyond our needs. Today, the degree of pollution production per person is both greater than ever before and rapidly increasing. We all participate in this dynamic, but not equally. Certain populations, in particular, engage in the consumption of resources to meet human demands that go well beyond need.

The focus of this book is human-produced hazardous pollution that harms human health in what I call environmental violence (EV).[2] In later chapters I will thoroughly map and track EV – its sources, outlets, consequences, and effects – but for now a definition will suffice: direct and indirect harm to humans caused by toxic and nontoxic pollutants put into the local (and concurrently the global) ecosystem through human activities and processes.

While this definition is relatively straightforward, I recognize that it sparks many important questions. Is it really *violence* if the polluting group does not intend to produce harm? Is the production of this harm, then, an intentional or unintentional act, and does it make a difference if one is aware that their activities create pollution? Aren't some groups causing violence to themselves, because they, too, are harmed by their own polluting activities? And these are just the proverbial tip of the (melting) iceberg. As a working definition, however, EV is still useful. It provides us with a paradigm for assessing the damaging impacts on humans of what has usually been looked at primarily as environmental harm. And, importantly, it allows us to do so on a broad and holistic scale, encompassing both the many forms of harm that may affect the human niche, as well as the multiple relevant scales of environmental dynamics, local and global.

In this book I will draw attention to three critical realities that underlie EV. The first is inequality, manifested in different ways: first, different populations unequally produce or contribute to EV; second, the risk and vulnerability associated with EV are unequally distributed; and third, correspondingly, the harm and power differentials experienced are realized unequally. These inequalities are not necessarily straightforward, as there are many complex factors at play in affecting them, and no one factor is determinative. The second critical reality underlying EV is that, despite these inequalities, ultimately all people are affected by it and face severe risk to their niche if destabilization of the Earth system continues. In the near-term, EV is a hazard for some people more than others, but ultimately it threatens everyone – the entire human niche and the Earth system. The third, and final, critical reality is that human-produced pollution triggers a process of violence and is, itself, violent. We will take an in-depth look at what I mean by violence, and at the evidence supporting these realities in Chapters 2–5.

I will then lay out a useful way to track, measure, and understand EV, namely through the theoretical framework known as human niche construction. Human niche construction involves the patterns and processes that humans carry out in their everyday lives that, over time, shape the ecological and cultural contexts they inherit in a dynamic process that results in new contexts and, ultimately, has evolutionary implications and outcomes (9–15). By thinking about EV through a human niche construction framework, we can systematically outline prevailing drivers and processes of EV. We can begin to parse its immense complexity, and subsequently trace its role in both contemporary contexts and human evolution more broadly.

Part of the difficulty of tracking EV is that some of the processes by which it is produced – or the resulting products – can provide a certain degree of benefit to individuals, communities, and society more broadly, but they eventually reach a point at which the costs exceed the benefits and damage to human health and wellbeing (i.e., violence) begins. Employing a human niche construction framework, in tandem with Earth systems theory and current estimates of anthropogenic environmental change, can help us to identify this point of diminishing returns and to contemplate why processes of production and consumption continue past this point. It will also aid in our discussion of the ethics of EV, particularly as we consider the ecological and cultural inheritances that will be transmitted to future humans – not to mention all the other biotic beings with which we share this planet.

The overarching argument that I make and support throughout this book is that human-produced and/or exacerbated environmental hazards should be considered violence, defined as the infliction of harm or injury (16). This is because they are the single largest source of human-caused death, are pervasive and rapidly growing throughout the entire contemporary human niche, and are, at the same time, largely preventable with the major per capita contributions attributable to a relatively small portion of the human population (17–21). Whether through the direct effects of toxic pollution on the human body, or the human health repercussions of the extreme weather events that are increasingly exacerbated by nontoxic pollution, EV is present, active, and expanding in the contemporary human niche and the Earth system at an alarming rate. This much will hardly come as a surprise to anyone following the daily news, with reports on everything from contaminated drinking water to arctic ice melt to devastated fish stocks. But the full picture of both the impact of EV and its human causes – the two things that make it, as I argue, *violence* – has not, so far, been successfully framed and understood. What this book will demonstrate is that the major driver behind the production of EV is *everyday life behaviors and patterns of consumption* that are so internalized and normalized that the violence they ultimately produce is either made invisible, seen as inevitable, or is incorrectly disconnected from its true causes. By the same token, while much has been made of some forms of environmental damage, EV is currently underestimated in the global ecosystem because most work to date has focused on singular pollution streams, rather than focusing on toxic and nontoxic pollution sources as interconnected and the effects of these two types of pollution as interactive and mutually catalyzing (22–31).[3] Ultimately, EV is produced and facilitated by the same complex of inequalities – the structural and cultural violence – that it creates, intensifies, and reinforces, resulting in a positive feedback loop that further perpetuates its existence and accelerates the cycle. Using EV as a model provides us with both a theoretical concept and an analytical tool, designed according to rigorous scientific evidence but with a normative intention, that can help us to dismantle this ongoing cycle of violence.

Before delving into the theory of EV, and an accompanying discussion of human niche construction theory (HNCT), it is important to illustrate a variety of concrete EV processes. The examples I present are pervasive enough that all humans engage in them in some form or fashion, even if unknowingly, and they should, therefore, serve as a good platform for parsing EV more completely.

1.1.1 Global Patterns of Environmental Change

Humans are now believed to be the single largest driver of geologic change on the planet, thrusting us into a new epoch many have dubbed the Anthropocene (e.g., Steffen et al. [32]). Part of this heightened impact is due to the fact that the human population has reached record numbers, owing to increased rates of reproduction and increased longevity (33, 34). The distribution of humans on the Earth today and the growth rate of the global population are vastly different than almost all of human history. During the twentieth century, the global human population increased fivefold, from 1.5 billion to approximately 7.5 billion people. For over 90 percent of human history, the world population was less than 5 million people, not crossing the 1 billion threshold until AD 1800 (35). It took humanity an estimated 3.6 million years to reach that threshold, but only ~12 years to go from 5 to 6 billion (1987–1999) and another ~12 years to go from 6 to 7 billion (1999–2011) (35). Interestingly, counter to previous expectations that global human population would be around 11 billion people by 2100 (36), the most recent global assessment of fertility and population scenarios, completed in 2020, indicates that population will peak around 2064 at 9.7 billion and decrease to 8.8 billion by 2100, marking the first intentional contraction of population in contemporary human history (33). Importantly, while population is expected to eventually taper and decrease, consumption per capita, and correspondingly total consumption, are not, continuing the path of unsustainable environmental degradation and destabilization (20, 35, 37–40).

While these numbers are staggering, they do not, by themselves, necessarily imply that humans must be the single largest driver of geologic change. It comes down to human behavior, that is, the ever-increasing amount of production and consumption per capita, and their coupled byproduct, pollution emissions (41). Indeed, consumption has outstripped the pace of population growth. From CE 1800 to 2000, human population increased sixfold, the global economy increased about fiftyfold, and energy use per capita increased about fortyfold (42). The rate of these processes is not evenly distributed across human populations. While the rate varies in part according to whether we look at consumption or at production, both tend either to be concentrated in infrastructurally developed countries and urban areas or geared to meet the demands of such areas (44–46).[4]

There are myriad ways human activities contribute substances to local ecosystems and the shared, global ecosystem.[5] I will parse out ecosystems and ecosystems thinking shortly but, for the purposes of this chapter, it is useful simply to keep in mind that all living and nonliving (biotic and abiotic) things operate in an ecosystem, and all ecosystems are interconnected (48–51).

One way to measure the amount of human-produced change in the global ecosystem is to track and measure atmospheric composition. Steffen et al. (32) demonstrate the increase in atmospheric greenhouse gas (GHG) composition starting from the development of contemporary humans (estimated at ~300,000 years ago) to the year 2005. They also include fertilizer use, damming of rivers, freshwater use, and several other indicators among the increasing human interference with ecosystems. All these measures display a marked, nonlinear increase at or around the year 1900 with a very pronounced rise in GHGs starting in that year, consistent with the rise of the Industrial Era. Their research convincingly reveals that, while humans have always had an influence on their environment, especially since the rise of agriculture and urbanism starting around 14,000–12,000 BCE, the twentieth century was an inflection point at which humans rapidly and significantly increased our influence on the rate and trajectory of geologic change. For this reason, they propose that 1945 is the beginning of a new epoch, the *Anthropocene*: the time at which humans assumed the role of the single largest driver of global environmental change. But how can we best make sense of what all this means in the larger timeline of human and geologic history?

1.1.2 Locating Our Current Moment in Geologic and Human History

The global ecosystem is dynamic – it is always in a state of flux (52). However, there are certain thresholds that, if surpassed, are believed to be "new grounds" for the planet and the global ecosystem (51, 53, 54). There are many ways to evaluate this, but three robust frameworks stand out: an Earth trajectory approach; an Earth system indicators approach; and a planetary boundaries approach. All three frameworks employ an Earth systems framework, where Earth systems refers to "the suite of interacting physical, chemical and biological global-scale cycles and energy fluxes that provide the life-support system for life at the surface of the planet" (Steffen et al. [32]: 615).

Earth systems frameworks are critical to conceptualizing and tracking EV because they lay out how our current actions and the resulting outcomes – particularly our production of EV – fit within the larger trajectory, history, and functioning of the Earth system. They also situate our "current moment" of humanity into both the rest of human history and geologic record. Additionally, it is critical to understand just how much change is really represented by "climate change," "global warming," and other terms used to denote the impacts of human action in the global ecosystem, because of how unusual the present degree and speed of change is in human history and evolution, and even in the geologic record (53, 55, 56). All these changes can – and in many cases already do – drastically affect human experience of everyday life and the modern human niche (56–58).

The Earth trajectory framework centers on human GHG emissions – generally considered a nontoxic form of pollution – and the corresponding outcome of global warming, which is one piece of our EV concept. We must keep in mind that GHGs are rarely emitted alone, but are most often accompanied by toxic copollutants such as sulfur dioxide (SO_2), nitrous oxide (N_2O), and particulate matter (PM2.5, particulate matter of 2.5 microns in size or smaller).

Steffen et al. (54) explore a concept called the "Hothouse Earth" using an Earth trajectory approach. Their contention is that there is a threshold that, if crossed, will push the Earth system into a hothouse state – a state of warming unseen in all of human and planetary history – and onto a trajectory that no amount of emissions reductions can redirect or stabilize. The threshold they explore is measured as the global mean temperature, with temperature increases primarily driven by human actions, specifically the production and release of GHGs.

Although the global mean temperature is always in flux, over the last 1.2 million years (the period labeled the Late Quaternary) the Earth system has oscillated between glacial and interglacial cycles lasting about 100,000 years in length and driven by Earth's orbital path and inclination to the Sun. It was during this period of cycles that anatomically modern humans evolved. The rate of the current warming trend is unprecedented, and Steffen and colleagues argue that this warming has already "committed the earth climate system to conditions beyond the envelope of past interglacial conditions" (54: 2), though not beyond the possibility of stabilizing the trajectory. What this means is that human action is driving the Earth system onto a trajectory that exceeds the limits of all contemporary human history and experience, and much of the experience of our premodern Homo ancestors. Our current position in this trajectory is still within the envelope of interglacial conditions over the past 1.2 million years, but only because of the lag effect between emissions and increased warming – that is, we have not yet fully realized the warming effect of our emissions to date (24, 59, 60).

Steffen et al. (54) estimate that, to stabilize the Earth system and remain on a path close to the glacial–interglacial cycling of the last 1.2 million years, emissions rates must be reduced to achieve a less than ~2-degree Celsius increase in global mean temperature as compared to pre-industrial levels. If the Earth warms above ~2 degrees Celsius, Steffen et al. (54) argue that there is a significant risk that, due to strong biogeophysical feedback loops and nonlinearities in inputs-to-outcomes, the Earth will be locked into a Hothouse Earth pathway.

What does the Hothouse Earth trajectory mean for the global ecosystem and humanity? It is likely that "the impacts of a Hothouse Earth pathway on human societies would be massive, sometimes abrupt, and undoubtedly disruptive" (54: 6). The Hothouse Earth trajectory shows how nontoxic pollution emissions, GHGS in this specific instance, are destabilizing the Earth system and sending it on a trajectory of warming never experienced by humans before and likely detrimental to us and to many other species. In early modern and premodern human history, drastic changes in climate resulted in population contraction through the deaths of many people (55, see 61–64).

The second Earth system framework is the Earth system indicators approach (65). Unlike the trajectories approach, which focuses on one effect of nontoxic GHG emissions, this Earth system framework includes both toxic and nontoxic pollution effects. Therefore, it accommodates the full spectrum of pollution streams encompassed in the EV concept. The Earth system indicators approach employs 12 measures of the human enterprise (socioeconomic measures) and 12 features of the Earth system. By including both socioeconomic and Earth system indicators, these measures show the inseparable interconnection between human and ecological processes in the Earth system. At the end of Section 1.1 I discussed several of these indicators as evidence of massive human impacts in the global ecosystem. The graphic displays of each indicator visually to highlight the abrupt and simultaneous inflection points of various human-produced emissions and other socioeconomic and environmentally consequential changes (see Figures 1.1 and 1.2).

This suite of indicators and their graphs have come to be known as the "Great Acceleration" graphs, as each depicts a consistent inflection point around the middle of the twentieth century (sometimes called a hockey stick trajectory), where input into the Earth system increased sharply. In aggregate, the graphs show the significant change in the materials created and the processes this production affects.

A skeptic might argue that the variables selected were chosen based on the inflection they show. This critique is, however, irrelevant, because both the socioeconomic and the Earth system indicators are essential components to the contemporary human experience and to Earth system functioning, respectively. Each of the socioeconomic variables represents something that has become an integral component of everyday human life: telecommunications, transportation, urbanism,

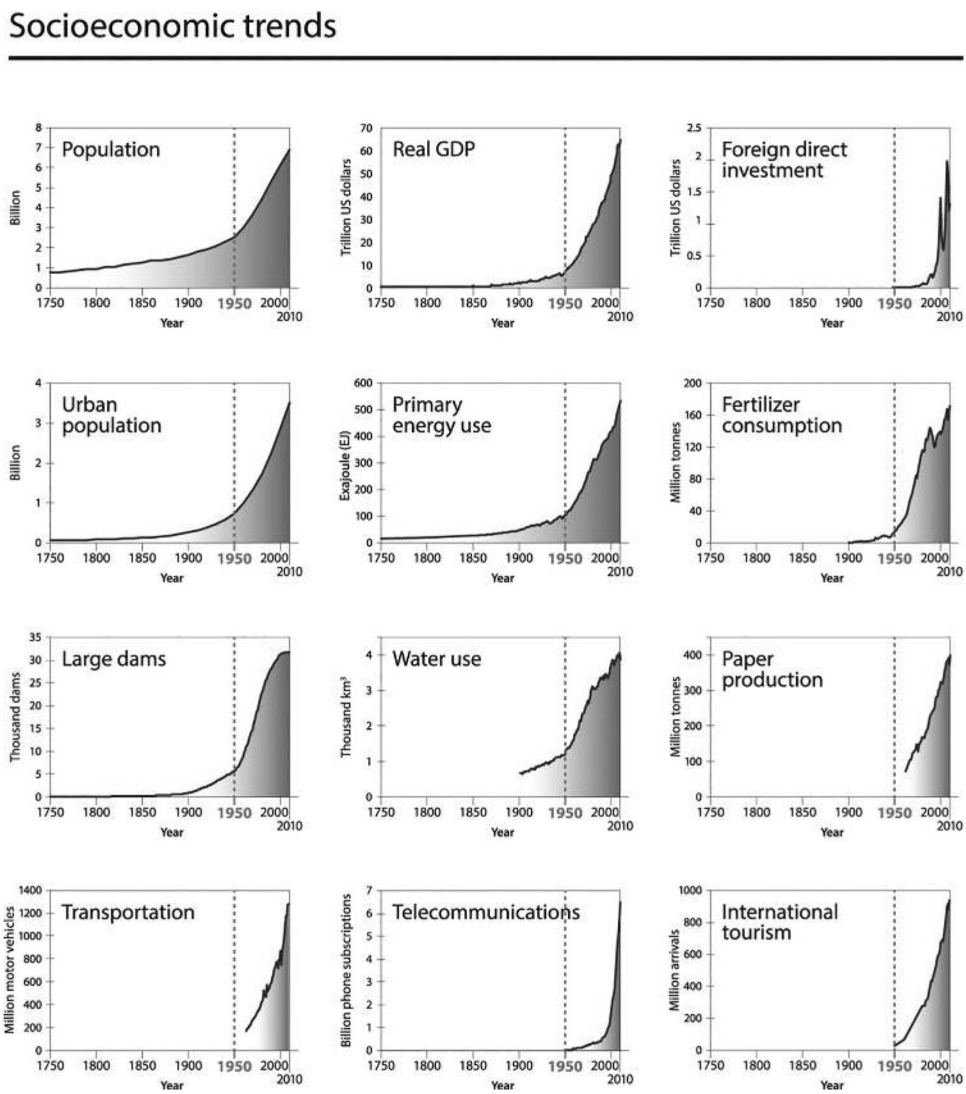

Figure 1.1 Socioeconomic trends indicators (65). See cambridge.org/marcantonio for the color version of this figure.

hydroelectric power, and so on. The Earth system variables are no less essential: ocean pH, atmospheric composition, global mean temperature, domesticated land, and so forth. Therefore, even if the variables were cherry-picked, they nonetheless represent drastic and important global environmental and cultural change. The Earth system is a complex adaptive system, and the characteristics measured by each graph are mutually shaping and influential, with varying feedbacks between them. Taken together, these indicators reveal that "the last 50 years have without

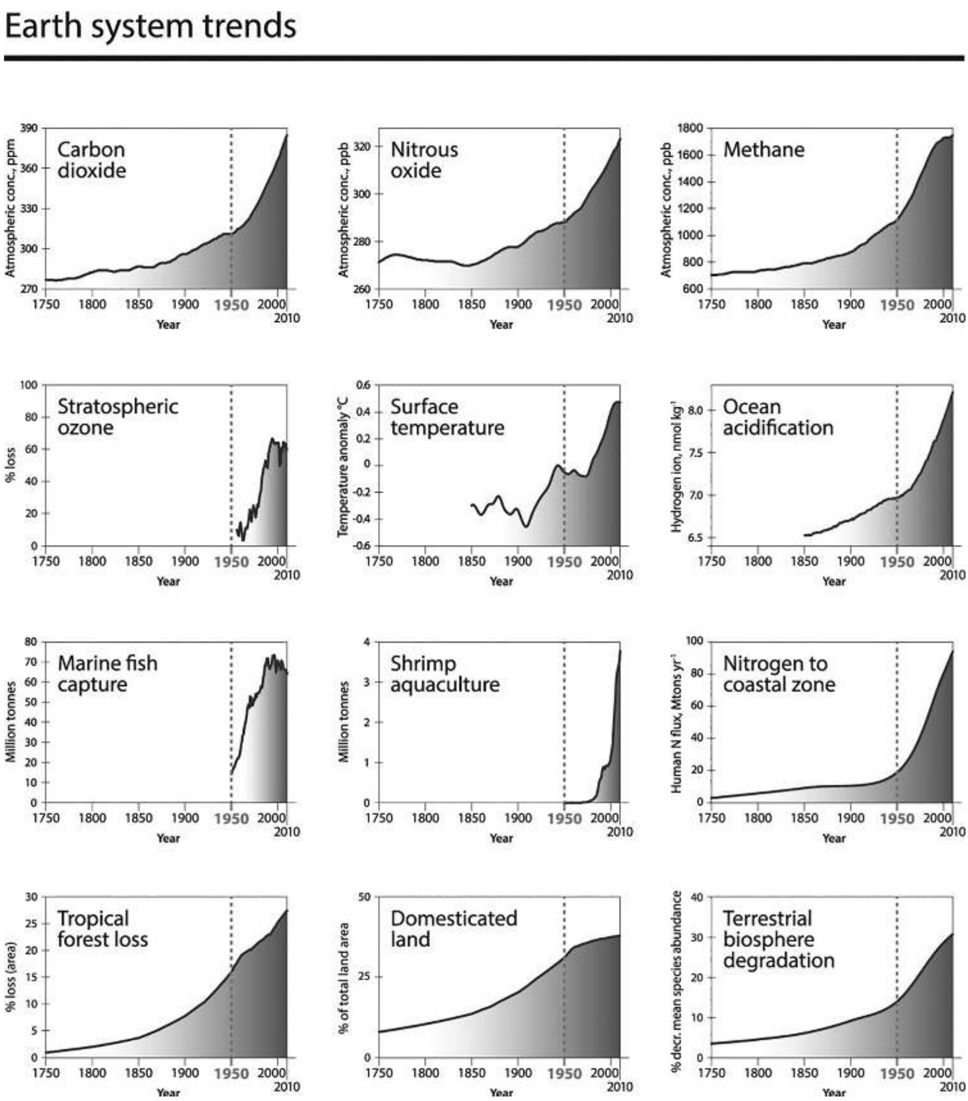

Figure 1.2 Earth systems trends indicators (65). See cambridge.org/marcantonio for the color version of this figure.

doubt seen the most rapid transformation of the human relationship with the natural world in the history of humankind" (65: 82).

In a third set of graphs (Figure 1.3), Steffen et al. (53) show the differential responsibility of different groups of countries (namely poor versus rich countries) for the drastic increase in the socioeconomic and Earth system measures, indicating that more developed countries are more responsible for the change in the Earth system. While some changes have enhanced the human experience, others have, or

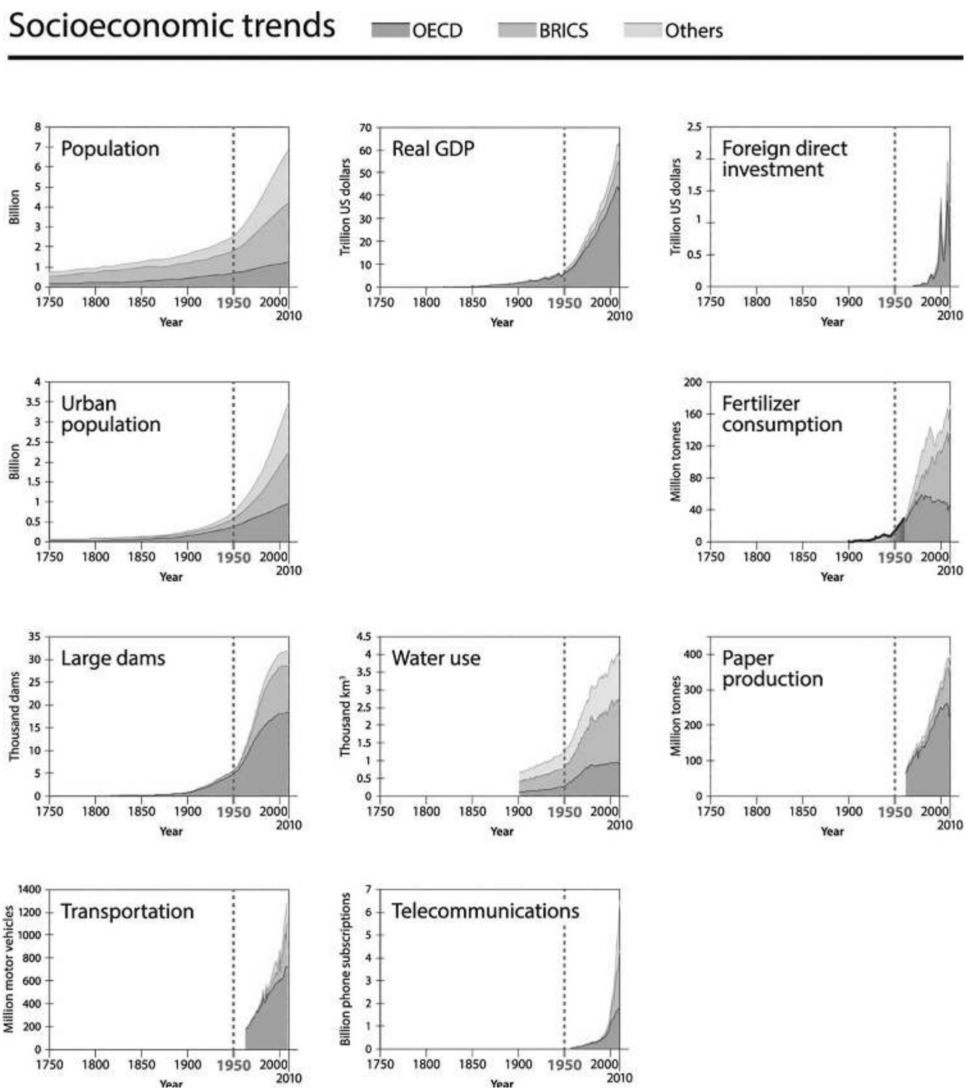

Figure 1.3 Socioeconomic trends indicators with attribution (65). See cambridge.org/marcantonio for the color version of this figure.

are projected to, degrade it. Differentiation between responsibility and net impact is a critical component of EV, and a nuanced parsing of the human production of EV and its costs and benefits will be an overarching topic throughout this book.

A third Earth systems framework, called the planetary boundaries framework, is also widely used to assess the state of the Earth system (51, 66). The planetary boundaries framework identifies nine critical processes that regulate Earth system functioning: climate change; ocean acidification; stratospheric ozone