PART III

PLAUSIBILITY 2: CONTRADICTION AND REPRODUCTION

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Chapter 5

Burdens of Empire

Contradictions and Reproductive Vulnerabilities

> Economic strength at home and abroad is the foundation of America's hard and soft power. Earlier enemies learned that America is the arsenal of democracy; today's enemies will learn that America is the economic engine for freedom, opportunity and development. (Robert Zoellick, 20 September 2001, in M. Mann 2003: 49)

> Despite the aura of omnipotence most empires project, a look at their history should remind us that they are fragile organisms. (A. McCoy 2010: 1)

Robert Zoellick, at the time President Bush II's trade representative, uttered the above quotation in the jittery days immediately after 9/11, reassuring everybody that America's "economic strength" was the "engine" of "freedom, opportunity and development." Assumed in Zoellick's discourse is that the imperial engine has plenty of "power" to go about its business. This chapter interrogates that assumption and in doing so submits that the most powerful social being in history—Leviathan of Leviathans—is at the same time, as McCoy put it in the second quote, "fragile."

Remember two points: first, that three major variables in global warring theory (contradiction, reproduction, and global warring) account for the power dynamics of empire; and second, that contradictions in this theory are supposed to intensify and coalesce, leading to reproductive vulnerability. The past chapter showed how the inter-imperial contradiction had led to reproductive vulnerability, which the security elites sought to fix by constituting their imperial Leviathan. If the economic system, as the ultimate producer of force, is viewed as the engine of a social being, then the present chapter probes the engine of the New American Empire. It details the relationship between economic contradictions and reproduction,

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seeking to discover whether contradictions have intensified and coalesced, producing vulnerabilities. At issue will be the state of cyclical and systematic, economic contradictions.

Up and Down, More Down

"In 1974–1975 the U.S. economy and the world economy as a whole entered a full-fledged structural crisis," involving "worsening conditions of accumulation" (Foster and McChesney 2009: 9). First it was good. The years immediately after World War II until roughly the mid 1970s have been called a "golden age" for US capitalism (Marglin and Shor 1992). Then it got bad. The years roughly from 1973 though the present have witnessed what is termed a "long downturn" (Brenner 1998: i) of the US economy—what Foster and McChesney term "a full-fledged structural crisis." This section shows how the long economic downturn corresponds to the intensification and coalescence of cyclical and systemic contradictions, which saddled the New American Empire with a reproductive vulnerability. Analysis reveals a double cycling of the US economy since 1945 that is up and down—maybe more down than up.[1]

Cyclical Contradictions

The double cycling of the US and global economy since 1945—a "long upturn" followed by a "long downturn" (Brenner 1998: i)—has been dramatic. So impressive was the upturn that it has been characterized as "the most sustained and profitable period of economic growth in the history of world capitalism" (McCormick 1989: 99). During its course, the Nobel Prize–winning economist Robert Solow (1970: 410) announced that the cycling of capitalist economies had been solved after all: "The old notion of a 'business cycle' is not very interesting any more." Solow was wrong. Joan Robinson reported that the expansion gradually ended in the late 1960s and by 1973 had turned into a "leaden age" (1962: 54). The world's annual GDP increase, which had averaged 3.6 percent during the 1960s, fell to 2.1 percent in the 1970s, 1.3 percent in the 1980s, 1.1 percent in the 1990s, and 1 percent in the 2000s (Bond 2006: 14–15). No serious economist challenges this characterization of the economics of the years since 1945.

A second cycle in the double cycling, occurring within the long downturn itself, has involved alternation between growth phases guillotined by five recessions in 1973–1974, 1981–1982, 1990–1991, 2001–2002, and 2008–2010. In the US economy the 1970s recession inaugurated a time

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of "stagflation"—the conjuncture of high inflation, high unemployment, and economic stagnation. Unemployment rose from 5.1 percent in January 1974 to 9.0 percent in May 1975. Inflation, which had averaged 3.2 percent annually following World War II, more than doubled in 1973 to a 7.7 percent annual rate. By 1979 inflation had reached 11.3 percent, and in 1980 it soared to 13.5 percent. The conservative hermeneut Martin Feldstein (Harvard and Oxford), writing at the end of the 1970s, observed: "There is a strong temptation to regard the poor performance of the past decade as the beginning of a new long-term adverse trend for the American economy. It is, however, too early to know whether such an explanation is really warranted" (1980: 2). It was.

Another recession began in 1980 and continued through 1982. Some have argued that this recession was initiated by attempts to deal with stagflation, especially a tightening of monetary policy by Federal Reserve Board Chairman Paul Volker. Decline in the US manufacturing sector became noticeable during this recession. In the mid 1960s manufacturing output was 27 percent of GNP; by 2003, these numbers had fallen precipitously to about 13.8 percent (McKinnon 2004: 1). By the 1980s the manufacturing sectors in other advanced capitalist countries—Japan and Germany especially—had rebounded from World War II, provoking serious competition with US industry. This competition was "one cause" (Plotnick et al. 2000: 285) of the deindustrialization that became serious in the 1980s. As a result of the deindustrialization, "older regions of the country had trouble recovering as entire industries collapsed, leaving distress in a wide swath that became known as the "Rust Belt" (Galambos 2000: 965) because of the severe job loss it suffered. Katherine Newman (1988: ix), writing of the 1980s, reported, "hundreds of thousands of middle class families plunge down America's social ladder every year." Additionally, the recession, in conjunction with deregulation, led to problems in the US financial sector throughout the late 1980s. On the Black Monday of 19 October 1987, a stock market collapse of unprecedented size—larger than that of 1929—reduced the Dow Jones Industrial Average by 22.6 percent, causing banks and savings and loan institutions to fail at exceptionally high rates (Lawrence White 1991). The US economic problems of the 1980s carried over into the early 1990s. The panic that followed the 1987 recession led to a sharp recession in the US in 1990, and for the next few years the US economy exhibited high unemployment, massive government budgetary deficits, and slow GDP growth.

Then, in the mid 1990s, the US economy rebounded. Trade opportunities expanded after the fall of the Soviet Union and its satellites. Technological developments brought a wide range of new electronic products. Telecommunications and computer networking advances led to an ex-

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panding computer hardware and software industry. The Internet was born. A dot-com boom began, based on companies' sales of products and services derived from the Internet. Also during the 1990s, at the urging of the Clinton administration, the financial sector was further deregulated. This led to the invention of novel financial instruments, especially derivatives like collateralized debt obligations or credit default swaps. Wall Street prospered greatly, at least for the next few years, and like the financial sector, so did the whole economy. Corporate profits rose quickly, inflation and unemployment were low, and strong profits sent the stock market surging as the Dow Jones Industrial Average, which had stood at just 1,000 in the late 1970s, hit the 11,000 mark in 1999. For this reason Joseph Stiglitz (2004: in the subtitle)—another winner of the Nobel Prize for Economics, a liberal hermeneut, and a member of President Clinton's Council of Economic Advisors—called the 1990s "the World's Most Prosperous Decade." Stiglitz was wrong. For the US and the world, the average annual GDP growth rate in 1990–1996 was lower both than it had been in either 1965–1980 or 1980–1990 (Palley 1999: 3). Worse trouble loomed.

In 2009 *Time* magazine announced that the US and the world were in "the Great Recession" (Gibbs 2009). Trillions of dollars in stock value were lost. For a time in 2008, Paul Krugman (2009) wrote that key economic indicators—such as world trade and world industrial production—"were falling as fast as or faster than they did in 1929–1930. But in the 1930s the trend lines kept heading down." The plunge appeared to have halted by 2010. However, "if the Great Recession," according to Foster and McChesney, "leveled off before plunging into the depths of a second Great Depression, it nevertheless left the US and world economies in shambles," where "capacity utilization in industry is a shadow of what it was only a year ago" (2009: 1).

So there has been a double cycling the US economy between 1945 and 2010: first upturn, then downturn; and then, within the long downturn, a second cycling as the economy ricocheted into and out of five recessions, with the last two occurring closer together and the last by far the gravest. This cycling, especially that of the long downturn, is explained in chapters 7 and 8, which will return readers to the overproduction discussed when considering US imperial growth at the end of the nineteenth century. Consider the next, systemic contradictions.

"Potential … Collapse"

> We're looking at potential system collapse, politically as well as physically. (Dyer 2008: 33)

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Gwynne Dyer, a environmental commentator, believes the world's ecology is at risk of "potential system crisis." Why? Prior to the present there were five major mass extinctions: the first 440 million years ago (mya); the second 370 mya, the third 245 mya, the fourth 210 mya, and the fifth 65 mya, which did in the dinosaurs. In 1995, E. O. Wilson estimated that about 30,000 species annually were being driven to extinction (Eldredge 2001). A few years later, the American Museum of Natural History (1998) in New York conducted a survey among biologists concerning these extinctions and found that "seven out of ten biologists" believed "that we are in the midst of a mass extinction of living things, and that this loss of species will pose a major threat to human existence in the next century." Dyer's "system crisis" is a sixth extinction and a "threat to human existence."[2] The narrative below argues that in some measure, the sixth extinction is propelled by a systemic contradiction roiling the US Leviathan. Marx will help to make this case.

An Ecological Marx: Marx, as others have observed, might be said to have had a love-hate attitude toward capitalism: on the one hand he despised what it did to people, but on the other he recognized that its productive forces (termed "economic force resources" in chapter 2) were extraordinarily powerful, driven as they were to ceaselessly accumulate. This continual growth, he believed, threatened capitalism with expansion beyond its structural limits and self-destruction. He conceptualized this destruction as a consequence of the contradiction between the development of productive forces and productive relations, where capitalists, to maintain or improve their position within prevailing competitive productive relations, choreographed their productive forces as fully as possible, propelling them toward their limits. Marx was especially interested in the productive force of labor (designated "actors" in chapter 2), believing that to accumulate capital capitalists needed to increasingly exploit the working class, motivating it to revolt and eradicate capitalism.

Marx was less interested in contradictions between capitalist production relations and the force resource of land (i.e., land/capital contradictions). Perhaps this was due to his distress over the fate of the proletariat during the development of capitalist productive forces. Perhaps it was also because there was little information about the effect of capitalist development upon natural resources in the mid nineteenth century.[3] Nevertheless, capitalists' *délires* to continually accumulate capital obliged them to utilize growing amounts of land. Capitalist farmers, for example, literally used increasing land areas, whereas steel manufactures used more and more iron ore.

Perpetual consumption of land resources could push production toward the limits in two ways. In the first, "indirect" way, continual use of a land

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resource might lead to changes that threaten production. For example, farmers might bring all the arable land into production and then over-farm it, causing drastic declines in soil fertility. In the second, "direct" way, the continual use of a land resource itself threatens production because the resource occurs in finite amounts. For example, it is possible that steel manufactures might use so much iron ore that they run eventually out of it. Contemporary capitalism appears to be rushing toward a systemic capital/land contradiction for both of these reasons.

The problem is energy. Capitalism, as shown earlier, must have energy—enormous amounts of it. Energy largely comes from burning hydrocarbons (i.e., fossil fuels such as oil, gas, and coal), which are forms of land whose combustion releases carbon dioxide. Hydrocarbons are limited, meaning consumption of them pushes capitalism toward its functional limits. Should fossil fuels be used up and not replaced by other energy sources, then the engine of capitalism might have its parts, but no energy to make them work. Further, burning hydrocarbons puts increasing amounts of carbon dioxide into the atmosphere, producing global warming, which can have dire consequences. Global warming and peak oil emerge as two manifestations of this intensifying capital/land contradiction.

Global Warming: Global warming indirectly influences capitalist accumulation, but in potentially calamitous ways. During Marx's lifetime, knowledge that greenhouse gases existed, and that their increase could cause global warming, was just beginning to be acquired. Now worldwide temperatures are increasing, creating a potential for global "catastrophe" (J. Hansen 2009).[4] Global warming—sometimes called the greenhouse effect—is the process by which absorption and emission of infrared radiation by gases in the atmosphere heats the planet's lower atmosphere and surface. The French mathematician and physicist Joseph Fourier (1824) first proposed this in the *Annales de Chimie et de Physique,* a journal Marx was unlikely to have read. After Marx's death, Svante Arrhenius (1896: 267) calculated that "if the quantity of carbonic acid [CO_2] increased in geometric progression, the augmentation of the temperature will increase nearly in arithmetic progression."

Greenhouse gases include carbon dioxide, methane, and certain other chemical compounds. A greenhouse gas permits solar radiation (sunlight) to pass through the atmosphere to the earth's surface and be re-radiated back into the atmosphere as longer-wave energy (heat). Greenhouse gases "trap" some of this heat in the lower atmosphere, thereby raising surface temperatures. The major greenhouse gases are water vapor, which causes about 36–70 percent of the greenhouse effect; carbon dioxide (CO_2), 9–26 percent; methane (CH_4), 4–9 percent; and ozone (O_3), 3–7 percent.

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The Intergovernmental Panel on Climate Change (IPCC), the UN agency instituted to scientifically evaluate climate change, states, "Warming of the climate system is unequivocal" (Solomon et al. 2007: 5). Global surface temperature increased 1.33 degrees Fahrenheit during the twentieth century. The concentration of carbon dioxide in the atmosphere was at 190 ppm (parts per million) 21,000 years ago.[5] It rose to 280 ppm just prior to the Industrial Revolution (c. 1700) and thereafter increased rapidly to 290 ppm in 1900, 316 ppm in 1959, 363.8 ppm in 1997, and 388 ppm in 2010. The current level of the "rate of increase" of CO_2 is "unprecedented in the paleoclimate record" (Houghton 2009: 90). At carbon dioxide levels above 350 ppm (Hansen 2009) the earth is believed to experience deleterious consequences, and

> recent results show that most of the adverse effects of global warming are running at or above the worst case predictions and records of only a few years ago—including the movement of Greenland glaciers, sea level rise, areas under drought and flood around the world, Arctic sea ice loss, oceans becoming acidic and warmer and reducing the amount of vital plankton in the seas, methane escaping from thawing permafrost in the Arctic, and a reduction of plant growth rather than an increase as many assumed. (Braasch 2010)

What made the greenhouse gases burgeon? Most greenhouse gases come from the burning of fossil fuels in the energy sector, by far the largest emitter of greenhouse gases (70 percent), followed by the land use sector (23 percent), waste management (4 percent), and industrial processes (3 percent). Yergin (1993) has documented the enormous increase in the fossil fuel industry. As these enterprises grow, more energy is required; as more energy is required, more oil, natural gas, and coal are burned; as more fossil fuels are burned, more greenhouse gases are emitted into the atmosphere, and the closer the global economy edges to systemic crisis. Clearly, "the origins of climate change are deeply rooted in the development of the global capitalist economy" (Newell and Paterson 2010: 9). Equally clearly, and ironically, capitalism is a force producing an unintended power, insofar as it causes "a climate increasingly inhospitable to the very industries most responsible for its warming" (Klein 2014). This irony is a contradiction: what capitalism does to be capitalism harms capitalism.

What harms can global warming inflict upon human life? Though respondents to this question are embroiled in heated debate, three generalizations seem safe. The first is that wealthy, Northern, capitalist countries will be better able to mitigate climate change's effects. The second is that wealthy, Northern elites will be less affected. The third is that the rest of humanity will likely suffer stark consequences. The Stern review provides a respected estimate of economic effects, forecasting that in the absence

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of serious mitigation, the costs of global warming will have reached 20 percent of total global output by the end of the twenty-first century (N. Stern 2007). Bear in mind that the bulk of these costs would be experienced in the poor South. Further, it is likely that the "most important impact of climate change will be an acute and permanent crisis of food supply" (Dyer 2008: ix). One report estimated that in the first decade of the twenty-first century, global warming was responsible for 300,000 deaths and $125 billion in economic losses each year (Vidal 2009). Should global warming worsen, humanity could become one of the 30,000 species that go extinct each year.[6] Global warming, however, is only a half of the capital/land contradiction, which brings us to peak oil and a more direct assault on capitalism.

Peak Oil: The significance of peak oil is made clear by the understanding of energy in physics as "the ability to do" or "the capacity to do work" (Heinberg 2003: 1). In the terms used in this volume, energy is produced by force. It is that which is has the ability to cause certain powers, that is, "to do" things. Clearly, actors' labor has its force, or energy, as do various instruments. However, the most important sources of force are those that can augment the powers of labor or instruments. This energy is acquired by a process that William Catton (1980) has called "drawdown": the consumption of stocks of energy provided by land. The use of wood to create fire is perhaps the first form of energy drawdown in human history.

Two sorts of drawdown might be distinguished: one utilizing renewable sources of energy that, once consumed, can be replaced; and the other using nonrenewable energy sources that are irreplaceable after they are consumed. Firewood burned to provide heat energy is a replaceable energy resource. Nonrenewable energy sources include "coal, oil, natural gas, and uranium" (Heinberg 2003: 28). Oil is a good example. According to Kenneth Boulding, distinguished founder of general systems theory, "In 1859 the human race discovered a huge treasure chest in its basement. This was oil and gas, a fantastically cheap and easily available source of energy. We did, or at least some of us did, what anybody does who discovers a treasure chest in the basement—live it up" (in ibid.: 43).

However, there was a problem. It had been known since ancient times that there was oil in the earth. But no one yet knew how to get at it; that is, no way of getting hold of the treasure in the chest had been discovered. But in 1859 Colonel Edwin Drake devised a way of drilling into the earth to get the oil in Titusville, Pennsylvania. Drake's drilling was successful: he had developed a drawdown technology to get at the treasure in the chest. Then, as industrialization spread throughout the globe, capitalist elites lived "it up," devising ways to use oil to run the various

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engines of economic activity. In our terms, a drilling technology had been invented to acquire oil from of land to provide the force for myriad economic practices.

Here it is useful to give an idea of the number and importance of these practices. Refined oil—diesel fuel, gasoline, jet fuel, kerosene, and liquefied petroleum gas—is fuel. In today's world, fuel is the most important energy source. Petroleum is also the raw material for many chemical products, including pharmaceuticals, solvents, fertilizers, pesticides, and plastics. Certain types of resultant hydrocarbons may be mixed with non-hydrocarbons to create other end products—alkenes that can be manufactured into plastics or other compounds; lubricants; wax; sulfur—or useful industrial materials like bulk tar; asphalt; the petroleum coke used in specialty carbon products; paraffin wax; and aromatic petrochemicals used as precursors in other chemical products.

Because these oil products are either the energy or raw material inputs in the running of large machines, petroleum is vital to industrial manufacturing. As the major fuel, oil is also crucial to transportation, which is essential to operation of nearly all industrial enterprise because it is the means by which distribution of products occurs, and distribution is necessary for profit realization and capital accumulation. Transportation in the form of affordable cars and cheap gasoline have enabled the suburbanization—with its associated housing developments, malls, offices, and parks—that distinguishes residential patterns increasingly found around the world. Transportation, in the form of cars, buses, airplanes, and ocean liners, underlies the tourism and recreation industries as well. Many fertilizers, herbicides, and pesticides are made from petroleum products, so oil is likewise crucial to agriculture. Finally, militaries rely upon oil-powered planes, helicopters, ships, armored vehicles, and the like—in other words, the instruments of war. Without the force resource oil, humans cannot grow the food, make the goods, run the armies, and work the educational systems and medias that are the economics, politics, and culture of contemporary social beings. Oil and gas, then, are force resources that enable other force resources to have power. No oil means no advanced modern capitalism.

Hence the problem: when Colonel Drake showed how to realize oil drawdown, he initiated huge utilization of an effectively nonrenewable resource. Most petroleum in the earth was made in the Jurassic period (180,000,000 million years BP) as the remains of tiny plants and animals were subjected to enormous amounts of heat and pressure. It is true that some oil is in the process of being made today, but it will take millions upon millions of years for this process to produce new oil. Consequently, the oil that is in the ground at present is effectively all there is.

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No one has exact knowledge of the amount of oil and gas in the ground. However, estimates of the amount of oil in the ground are based on the proven reserves of oil in each country.[7] A recent estimate puts this at 1,477 billion barrels of crude oil (OPEC 2014)—a lot of oil, but at the same time all there is. Once consumed, it is no more, and if there is no petroleum replacement, there is no capitalism. Currently, despite theoretical concurrence that some replacement(s) for oil could exist, theory is not yet actuality. No energy source that now exists can replace oil and gas (see Kunstler 2006: 100–147). This realization highlights the importance of understanding the likely history of oil utilization. At this point the work of M. King Hubbert becomes relevant.

Hubbert (1956), a geophysicist and sometime employee of Shell Oil, theorized the trajectory of oil's development. He hypothesized that oil supplies, like other limited resources, would take the form of a bell curve: an ascending slope as output increased; a highest point before decrease set in; and a descending slope as output decreased. At the high point, now known as "Hubbert's Peak," oil output stagnates and then declines, whereupon economic tribulations caused by dwindling supply commence. It was unclear how analysts would know the production peak had been reached, though situations where oil demand exceeded supply would be a likely indicator that peak oil was approaching or had arrived. Initially Hubbert's position was viewed with disdain. However, his prediction that US oil production would peak in the 1970s was borne out to some extent: US oil production reached its highest point in the 1970s and thereafter declined, until the development of fracking techniques.

Enormous amounts of oil have been consumed since the publication of Hubbert's views in the 1950s. This represents an enormous drawdown on Boulding's "treasure chest in the basement." An influential Department of Energy study known as the Hirsch Report evaluated the implications of this petroleum consumption, concluding that "peaking *will* happen" (Hirsch, Bezdek, and Wendling 2005: 64). When is "not known" (ibid.: 5), but the report foretold "dramatically higher prices" upon its occurrence, producing "massive demand destruction" and "protracted economic hardship" (ibid.: 5, 65). There would be an inverse relationship between the amount of petroluem produced and capitalist enterprise, for as the amount of oil produced diminished, industrial production decline would intensify, damaging other sectors of capitalist economies in a cascading effect. Hirsch and his co-authors bluntly warned that "*t*he world has never faced a problem like this" (ibid.: 64). The Hirsch Report was reluctant to forecast when peak oil would arrive. Hubbert was bolder. He predicted it was likely to happen around 1995–2000 (Grubb 2011). The inverse relationship just identified between petroleum production and capitalist enterprise means an intensi-

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fying land/capital contradiction involving hydrocarbons. As these productive, land forces are increasingly developed, capitalist enterprise's capacity to survive—let alone accumulate capital—decreases.

One further point concerns the positive relationship between hydrocarbon utilization and global warming. As Heinberg (2003: 3) explains, "The world's oil and coal fields represent vast stores of carbon that have been sequestered under the earth's surface for hundreds of millions of years," and the burning of these petroleum and coal products releases huge amounts of carbon into the atmosphere, contributing to global warming. The co-occurrence of growing global warming and the arrival of peak oil warns of a rapidly increasing, systemic capital/land contradiction and the "potential" for "system collapse." There is lively debate over whether humans will be part of the ongoing sixth extinction, but no debate about whether this is possible. It is time to conclude the present chapter by recognizing where we stand in the argument establishing the plausibility of global warring theory.

Very Late Modernity

Chapters 4 and 5 explained that the US is and has been a shape-shifting empire from its very beginnings in 1783, and that by 1950 it had become the New American Empire. This chapter has examined its economic contradictions since 1950. Economic elites choreographed events in the quest for capital accumulation. This pursuit resulted in *both* coalescing and intensifying cyclical and systemic contradictions, raising reproductive vulnerabilities. The US Leviathan might be the most powerful social being in the history, but its vulnerabilities make it a brittle one.

Next consider the first general proposition of global warring theory—namely, that

> intensification and coalescence of an empire's political and economic contradictions increase its reproductive vulnerabilities.

Certainly the information in this and the previous chapter support this proposition. Later chapters will further document how worsening contradictions, and the vulnerabilities they generate, lead to more heremenutics and public *délires,* and eventually to global warring.

Finally, this chapter clarifies why the present is a time of *very* late modernity. In this book's introduction, modernity was said to be a period dominated by institutions of capitalist logic articulated with imperial state forms. This chapter and the last have suggested that the New American Empire is a generator of contradictions pushing it toward its limits. The

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Leviathan is subject to immanent and imminent disordering—immanent because the empire's deconstructing contradictions are *within* its own economic and political systems; imminent because this disordering might arrive momentarily. Jonathan Fowler (2013), reporting on the World Meteorological Organisation's data on the growth rate of global warming gases in the atmosphere, notes that experts warn that unless more is done soon to address greenhouse emissions, "the world faces potentially devastating effects." If this is the case, then, this is *very* late modernity, because of the imminence of "devastating effects." Reproductive fixes involving pragmatic heremenuetics, public *délires,* and war are urgently required in response to such "devastating" vulnerabilities.

The chapters in the next section tell the story of security elites swinging into action through the logic of social constitution, among other things using violent force to fix vulnerabilities. So, readers, it is time to go to war.

Notes

1. Brenner, McChesney, and Foster are political economists, and it might be concluded that only the left insists a long downturn has occured. The liberal economist Paul Krugman (1997) wrote—as the title of his book makes clear—that as of the 1970s it became *The Age of Diminished Expectations.* In the 1970s Edward Denison (1979), a centrist economist, began, as the title of his book puts it, *Accounting for the Slower Economic Growth* in the US.

2. Kolbert (2013) and Hartmann (2013) provide introductions to the considerable discussion of the sixth extinction. MacKenzie (2011) reports on some studies that assert the rate of extinctions has been overestimated; Wynne Parry (2012) reports on those arguing the opposite.

3. Foster (2000) has explored Marx and Engels's ecological views, highlighting their belief that capitalism resulted in a "metabolic rift" between people and nature, expressed especially in declining agricultural soil fertility. However, it is important to not make Marx and Engels into something they were not. Both were primarily interested in the condition of the working class, not in soil fertility, so their concern was to explain people-people relations, not people -land relations.

4. Houghton (2009) provides an overview global warming from the perspective of conventional economics. Braasch and McKibben (2009) consider the topic from an activist perspective; Foster (2009), from a leftist angle.

5. The ppm measure of CO_2 in the atmosphere is the ratio of CO_2 molecules to all other molecules in the atmosphere.

6. Global warming might cause a massive release of methane from clathrates—deposits of methane produced by bacteria trapped in ice, usually on ocean floors or in Arctic permafrost. Enormous amounts of methane (an estimated 400 billion tons) are trapped in clathrates, and methane is 70 times more potent as a greenhouse gas than CO_2. When clathrates melt, as they are likely to do as the globe warms, methane is released through degassing, or more colloquially "burping," into the atmosphere. Such burps can greatly raise temperatures. It appears that the last major clathrate burp occurred during the third major extinction at the end of the Permian Period. This time has come to be known as the Great Dying because approximately 90 percent of all animal life ceased to exist (Benton 2003). Humanity could cease, should global warming lead to another clathrate burp like the one that ended the Permian.

7. Petroleum reserves are guesstimates, and estimates tend to be optimistic.

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