**Magdoff, F. & Foster, J.B. (2011). *What every environmentalist needs to know about capitalism: A citizen's guide to capitalism and the environment.* New York: Monthly Review Press.**

## Preface

> Wealth, if limits are not set for it, is great poverty.
> -EPICURUS[1]

Ecological economist Herman Daly is well known for emphasizing what he has called the "Impossibility Theorem" of unlimited economic growth in a limited environment. Put concretely, an extension of a U.S.-style high consumption economy to the entire world of 7 billion people—much less the 9 billion-plus world population projected for the middle of the present century—is a flat impossibility.[2] In this book we are concerned with extending Daly's Impossibility Theorem by introducing what we regard to be its most important corollary: the continuation for any length of time of capitalism, as a grow-or-die system dedicated to unlimited capital accumulation, is itself a flat impossibility.

We are constantly being told by the vested interests—and even by self-designated environmentalists and environmental organizations—that capitalism offers the solution to the environmental problem: as if the further growth of capital markets, green consumption, and new technology provide us with miraculous ways out of our global ecological dilemma. Such views are rooted in an absolute denial of reality, or what John Kenneth Galbraith has called a system of "innocent fraud."[3] In this make-believe, *Through the Looking Glass* world, the wondrous workings of markets, perhaps tweaked here or there by regulations and incentives, make miracles possible. In the process, the laws of physics, chemistry, biology, and ecology—as well as the limits of the earth—are simply conjured away. Fundamental changes in our mode of existence and our lifestyle are not required: another world is not necessary.

All of this raises questions about what constitutes environmentalism. Today, more people than ever are convinced that the degradation of the earth's life support systems is leading us toward catastrophe. Whether they are environmental activists or riot, growing numbers of people are concerned about the environment and are taking small steps, and willing to do much more, in order to protect the planet. For all those concerned with the fate of the earth, the time has come to face facts: not simply the dire reality of climate change and other forms of environmental destruction, but also that there is a pressing need to change the basic relationships between humanity and the earth. Put simply, it is essential to break with a system based on a single motive—the perpetual accumulation of capital, and hence economic growth without end. Such a break is a necessary, if not sufficient, condition for the creation of a new ecological civilization.

This book grew out of an article with the same title, originally published in the March 2010 issue *of Monthly Review.*[4] Interest in our article was so great that we were encouraged to expand it into a short book. This brief work thus is a product of its origins. We have not tried to present a systematic discussion of the entire planetary ecological crisis, though many aspects of that are touched on here.[5] Rather our goal is to provide a useful introduction to the issue laid out in our title: *What Every Environmentalist Needs to Know about Capitalism.* What every environmentalist needs to know, of course, is that capitalism is not the solution but the problem, and that if humanity is going to survive this crisis, it will do so because it has exercised its

capacity for human freedom, through social struggle, in order to create a whole new world—in coevolution with the planet.

Our personal and intellectual debts in relation to this work are too vast to acknowledge in full. However, we would like to thank especially Hannah Holleman and Jan Schultz, who aided and assisted us in the preparation of the present manuscript at various stages of completion.

We would also like to acknowledge the political and intellectual support of those at *Monthly Review,* Monthly Review Press, and *MRzine,* without which this work would have been inconceivable, including: Scott Borchert, Brett Clark, Susie Day, Yoshie Furushashi, John Mage, Martin Paddio, John Simon, Victor Wallis, and Michael Yates.

Some of our close friends, colleagues, and students have contributed to our understanding of ecological issues in ways that have impacted this book: including Matthew Clement, Cade Jameson, R. Jamil Jonna, Brian Tokar, Ryan Wishart, and Richard York.

During the last two years, while working on the ideas in this book, we have traveled to Bolivia, Brazil, China, Venezuela, and Vietnam to discuss ecological issues. We are thus constantly reminded that the ecological movement is a planetary one. We would like to thank the many individuals from many different cultures that we have encountered in these journeys.

Finally, we would like to offer our heartfelt thanks to Amy Demarest and Carrie Ann Naumoff, with whom we share our lives on this earth and our struggles for a sustainable future.

JUNE 5, 2011
FLETCHER, VERMONT
EUGENE, OREGON

## Chapter 1
## The Planetary Ecological Crisis

> Let us not, however, flatter ourselves overmuch on account of our human victories over nature. For each such victory nature takes its revenge on us. Each victory, it is true, in the first place brings about the results we expected, but in the second and third places it has quite different, unforeseen effects which only too often cancel the first.
>
> —FREDERICK ENGELS[1]

Environmental degradation is not new to today's world but has occurred throughout recorded history with profound negative consequences for a number of ancient civilizations—most notably Mesopotamia and the Maya, which experienced major collapses due to what are believed to be ecological causes. Problems with deforestation, soil erosion, and salinization of irrigated soils were present throughout antiquity. Commenting on the ecological destruction in ancient Greece Plato (c. 427-347 BCE) wrote in *Critias:*

> What proof then can we offer that it [the land in the vicinity of Athens] is ... now a mere remnant of what it once was?...You are left (as with little islands) with something rather like the skeleton of a body wasted by disease; the rich, soft soil has all run away leaving the land nothing but skin and bone…For some mountains which today will only support bees produced not so long ago trees which when cut provided roof beams for huge buildings whose roofs are still standing. And there were a lot of tall cultivated trees which bore unlimited quantities of fodder tor beasts. The soil benefitted from an annual rainfall which did not run to waste off the bare earth as it does today, but was absorbed in large quantities and stored in retentive layers of clay, so that what was drunk clown by the higher regions flowed downwards into the valleys and appeared everywhere in a multitude of rivers and springs. And the shrines which still survive at these former springs are proof of the truth of our present account of the country.[2]

What makes the modern era stand out in this respect, however, is that there are many more of us inhabiting more of the earth; we have technologies that can do much greater damage and do it more quickly; *and* we have an economic system that knows no bounds. The damage being clone today is so widespread that it not only degrades local and regional ecologies, as in earlier civilizations, but also affects the planetary environment, threatening the existence of a majority of species on the planet, including our own. There are therefore sound, scientific reasons to be concerned about the current rapid degradation of the earth's environment.

What we call *the* environmental problem today is not reducible to a single issue no matter how large, but rather consists of a complex of problems. One of the latest, most important developments in Earth system science, developed by leading scientists, is the concept of "planetary boundaries," in which nine critical boundaries/thresholds of the earth system have been designated (or are being considered) in relation to: (1) climate change; (2) ocean acidification; (3) stratospheric ozone depletion; (4) the bio-geochemical flow boundary (the nitrogen and phosphorus cycles); (5) global freshwater use; (6) change in land use; (7) biodiversity loss; (8) atmospheric aerosol loading; and (9) chemical pollution. Staying within each of these boundaries is considered essential to maintaining the relatively benign climate and environmental conditions that have existed during the last 12,000 years (the Holocene epoch). The sustainable boundaries in three of these systems—climate change, biodiversity, and human interference with the nitrogen cycle (part of the biogeochemical flow boundary)—have already been crossed, representing extreme rifts in the Earth system, while others—ocean acidification, global freshwater use, changes in land use, and the phosphorus cycle—represent emerging rifts. (Proposed boundaries for atmospheric aerosol loading and chemical pollution have yet to be designated.)[3]

Although each of these rifts in planetary boundaries constitutes a major threat to life on the planet as we know it, it is climate change that is the biggest, most immediate threat, occupying a particularly central place, since it overlaps with all the others. Human-induced increases in greenhouse gases (carbon dioxide, methane, nitrous oxide, etc.) are destabilizing the world's climate. If humanity does not soon change course, this will probably have horrendous effects for most species on the planet, including our own. Each decade is warmer than the one before, with 2010 tying with 2005 as the warmest year in the 131 years of global instrumental temperature records, and with nine of the warmest years on record in the last decade.[4]

Indications of accelerating problems directly tied to climate change are already beginning to manifest themselves. These include:

• *Melting of the Arctic Ocean ice during the summer, which reduces the reflection of sunlight, thereby enhancing global warming.* Satellites show that end-of-summer Arctic sea ice was 40 percent less in 2007 than in the late 1970s when accurate measurements began.[5] The three years with the least Arctic Sea ice cover at the end of summer were 2007,2008, and 2010.[6]

• *A rise in sea level that has averaged 1.7 millimeters (mm) per year since 1875, but which since 1993 has averaged 3 mm per year, or over an inch per decade, with the prospect that the rate will increase further.* The eventual disintegration of the Greenland and Antarctic ice sheets, set in motion by global warming, may result in a huge rise in ocean levels. Even a sea level rise of one to two meters would be disastrous for hundreds of millions of people in low-lying countries such as Bangladesh, Vietnam, and various island states. At present, the Arctic Monitoring and Assessment Program, the scientific arm of the eight-nation Arctic Council, is projecting rises in sea level by as much as just over a meter and a half this century based on current trends.[7] A sea level rise at a rate of a few meters per century is not unusual in the paleo-climatic record. At present, more than 400 million people live within five meters of sea level, and more than one billion within 25 meters.[8]

• *The rapid decrease of the world's mountain glaciers, many of which—if business-as-usual greenhouse gas emissions continue—could largely be gone during this century.* Some 90 percent of mountain glaciers worldwide are already visibly retreating as the planet warms. The Himalayan glaciers provide dry season water to hundreds of millions of people in Asia; their shrinking will lead to floods and acute water scarcity. Already the melting of the Andean glaciers is contributing to floods in that region. In April 2010 some fifty people were injured in Peru as part of a glacier fell into a glacial lake, causing the Hualcan River coming from the lake to over-flow its banks.[9] But the most immediate, current, and long-term problem, associated with disappearing glaciers—visible today in Bolivia arid Peru—is that of water shortages, because the glaciers function as water storage reservoirs.[10]

• *Warming of the oceans, where some 90 percent of the heat added to the planet has accumulated.* This has been implicated in a dramatic decrease in the phytoplankton (microscopic plant-like organisms) that are at the bottom of the ocean food chain—with much of the decline occurring in the last fifty years.[11] Although other causes besides global warming may be involved (see discussion of ocean acidification below), such a remarkable decline of productivity at the base of the ocean's food chain will undoubtedly have a profound negative effect on the future overall productivity of the seas.

• *Devastating droughts, expanding possibly to 70 percent of the land area within several decades under business as usual.* Effects are already evident in northern India and northeast Africa; while Australia experienced a ten-year drought in the opening decade of this century

(with the rains only just returning).[12] But even when rains come, they frequently are so intense that flooding and loss of life occurs, as with the 2010 floods in Pakistan and the 2011 floods in Australia. As reported in the *Independent* (UK) with respect to Pakistan: "The twin hazards of perilously low levels of water for most of the year followed by summer weeks of calamitous flooding illustrate the scale of the problem for countries such as Pakistan. It is often the same countries that suffer limited supplies of clean water that also endure flood devastation."[13]

• *Warmer winter and summer temperatures that have already upset regional ecosystems.* One example concerns the white bark pine tree that normally grows to a very old age—with some over a thousand years old—on the upper elevations of the western mountains in the United States. These stands have provided habitat and food for many species of birds and mammals, including bears. The pine bark beetle, now able to reproduce at the higher elevations because of warmer temperatures, is infesting these zones and turning huge areas of white bark pine trees into "ghost forests." The death of the forests in turn means no food for the animals, forcing them to move to lower elevations. In addition, snow melts more quickly in the dead forests, causing faster melt and runoff in the spring and low and warm rivers in the summer, with adverse effects on fish.[14]

• *Negative effects on crop yields as average global temperature rises.* Higher levels of $CO_2$ in the atmosphere may increase the production of some types of crops, but they may then *be* harmed in future years by a destabilized climate that brings either dry or very wet conditions. Losses in rice yields have already been measured in parts of Southeast Asia, attributed to higher night temperatures which cause the plant to undergo enhanced night-time respiration. This means that plants at night lose more of what they produced by photosynthesis during the day.[15] A study-in Africa found that for each day the temperature was above 30° C (86° F) corn yields decreased by one percent if plentiful water was available and by 1.7 percent under drought conditions.[16] A study of climate and agricultural production since 1980 indicates that detectable decreases in global corn and wheat production are already occurring due to changes in climate.[17]

• *Extinction of species due to rapid shifts in climate zones or "isotherms"—regions in which a given average temperature prevails and to which specific species are adapted.* Studies of more than a thousand species of plants, animals, and insects have found that whereas the average migration to the north and south (toward the poles).was four miles per decade in the second half of the twentieth century, isotherms have been "outrunning" species, moving poleward at a rate of about 35 miles per decade over the last thirty years. At the same time species that live at the poles (such as polar bears) and in alpine regions have nowhere to move and are simply being run off the earth.[18]

All of this points to the fact that climate change does not occur in a gradual way, with equal change each year, but rather takes the form of tipping points fed by amplifying feedbacks that can hasten change and its consequences. Seen in this way, the melting of Arctic ice is an "amplifying feedback." The rapid melting of white ice and its replacement with blue seawater is decreasing the earth's reflectivity (the albedo effect) resulting in the absorption of additional radiation and the acceleration of global warming. Such amplifying feedbacks shorten the time separating us from major tipping points, beyond which there is no stopping a process. Such a major tipping point, as we have mentioned, is the disintegration of ice sheets in Greenland and West Antarctica, which would lead to a dramatic rise in world sea levels. Loss of the entire West Antarctic ice sheet would raise sea level by 20 to 25 feet and open the way to the ocean for the much larger East Antarctic ice sheet.[19]

**Other Planetary Rifts**

Climate change, as noted, is only one of a number of planetary rifts brought on by the crossing of planetary boundaries.

Like climate change, ocean acidification is a product of increased emissions of carbon dioxide. The boundary for ocean acidification, recently proposed by scientists, is determined on the basis of the global mean saturation state of aragonite (a form of calcium carbonate) in surface seawater. A decline in the number indicates an increase in the acidity of the ocean. The preindustrial value was 3.44 (surface ocean aragonite saturation state); the proposed boundary—after which there would be a massive die-down of shell-forming organisms—is 2.75; and the current state is 2.90. Ocean acidification is often referred to as the "evil twin" of climate change, since it derives from increases in carbon dioxide emissions and has equally devastating implications for the planetary system.[20]

One area that appears to have been brought under control in the 1990s, but raised serious concerns because of the rapid increase in ultraviolet radiation from the sun that was occurring up to that time, is stratospheric ozone depletion. The preindustrial value of ozone concentration was 290 (in Dobson Units—the measurement of atmospheric ozone columnar density); the proposed planetary boundary is a concentration of 276, after which life on the planet would experience devastating losses; and the current status is 283. The decline in stratospheric ozone concentrations has now been halted between GO°S and 60°N. Nevertheless, it will take decades for the Antarctic ozone hole to disappear, and Arctic ozone loss will also likely persist for decades. Life on the planet had a close call.[21]

The preindustrial annual rate of species loss, considered the "natural" or "background" rate, was 0.1-1 per million. The planetary boundary recently proposed by scientists is 10 per million, whereas the current rate is greater than 100 per million (100 to 1,000 times the preindustrial background rate).[22] Species are disappearing at accelerating rates not only because of global warming but also—more importantly at present—through direct human impact on species' habitats. We are living m an era that scientists have characterized as the "sixth extinction," which threatens to rival the great mass extinctions of the geological past, the most recent of which was the dying out of the dinosaurs 65 million years ago. The sixth extinction, emerging in our time, is distinct from these earlier mass extinctions in that it is brought on chiefly by a living species: our own.

A 2009 survey by the International Union for Conservation of Nature estimated that over 17,000 animals and plants are at risk of extinction. "More than one in five of all known mammals, over a quarter of reptiles, and 70 percent of plants are under threat, according to the survey, which featured over 2,800 new species compared with 2008. 'These results are just the tip of the iceberg,' said Craig Hilton-Taylor, who manages the list. He said many more species that have yet to be assessed could also be under serious threat."[23] As species disappear, ecosystems that depend on a multitude of species to function begin to degrade. One of the many consequences of degraded ecosystems with fewer species appears to be greater transmission of infectious diseases.[24]

The overloading of the environment with nitrogen and phosphorus runoff from fertilizers represents another ecological rift affecting the biogeochemical cycles of the planet. For nitrogen the proposed boundary introduced by scientists is concerned primarily with the amount of nitrogen removed from the atmosphere by chemical means (the Haber-Bosch process), as well as nitrogen fixation through the cultivation of legumes, in millions of tons per year. Before the rise of industrial capitalism (more specifically before the rise of the Haber-Bosch process early in the twentieth century) the amount of nitrogen removed from the atmosphere was relatively low. The proposed boundary limit to avoid global ecological degradation from excess nitrogen is

35 million tons—including both agricultural legume-fixed nitrogen and the industrial production of "fixed" nitrogen (mainly for nitrogen fertilizers)—while its current status is 121 million tons. Although the limit suggested is not sufficient to produce all the needed grain crops, it is clear that annual nitrogen fixation can, and should, be reduced significantly from its current level with better systems in place to cycle nutrients in human and animal waste back to farmland. In spite of the fact that phosphorus runoff is currently less of a threat than nitrogen, it is rapidly growing in significance. The preindustrial amount of phosphorus flowing into the oceans per year was 1 million tons. The proposed boundary is 11 million tons, while the current status is 8.5 to 9.5 million tons and rising rapidly.[25]

There are literally hundreds of locations around the world where these chemicals, flowing into the oceans, are resulting in an explosion of phytoplankton. As the massive quantities of phytoplankton die, decomposing organisms lower m the oceans create very low oxygen zones-technically referred to as hypoxic or low oxygen zones, but sometimes called "dead zones"—in which many species of fish cannot exist. One of the largest of these is the dead zone where the Mississippi River enters the Gulf of Mexico. The largest such area occurs in Europe's Baltic Sea.

The global freshwater boundary is also being transgressed. Thresholds of both blue water (liquid) flows and green water (vapor) flows are being disrupted, threatening the entire hydrological cycle. At present an estimated 25 percent of the world's river basins run dry before reaching the oceans as a result of human use of freshwater resources. The preindustrial use of freshwater was 415 $km^3$ (cubic kilometers) per year. The proposed boundary for freshwater consumptive use recently designated by scientists (beyond which there is a significant risk of collapse of terrestrial and aquatic ecosystems on regional arid continental scales) is 4,000 $km^3$. The current status is 2,600 $km^3$.[26]

With respect to direct human needs, the global freshwater crisis is already upon us. As Maude Barlow writes in *Blue Covenant:* "The world is facing a water crisis due to pollution, climate change and a surging population growth of such magnitude that close to two billion people now live in water-stressed regions of the planet. Further, unless we change our ways, by the year 2025, two-thirds of the world's population will face water scarcity."[27] In some areas, such as northern China, northern India, and the part of the U.S. Great Plains that sits over the Oglala aquifer, water is being pumped out faster than it can be replenished, with deeper extraction only delaying the end of these sources. In the Punjab region, which grows about half of India's grain reserves, water is being pumped out of the ground 45 percent faster than rams can replenish it[28]—a recipe for disaster.

Changes in the land use associated with human production represent a further rift in planetary boundaries. The conversion of forests and other ecosystems to agricultural land is reaching what scientists believe to be a critical threshold, threatening biodiversity and undermining the regulatory processes of the Earth system. For example, conversion of the Amazon rain forest into agricultural land could reach a level where it would tip the rain forest system into that of a semi-arid savannah. In South America, rain forests are commonly first converted to extensive pastures and later used for export crops such as soybeans. In Southeast Asia land is being converted into oil palm plantations—with the oil exported as a feedstock for making biodiesel fuel. This destruction of tropical forests, in addition to displacing the forests' indigenous people, is causing an estimated 25 percent of all human-induced release of $CO_2$.[29] Soil degradation by erosion, overgrazing, and low levels of organic matter application threatens the productivity of large areas of the world's agricultural lands.

There were relatively low amounts of preindustrial anthropogenic changes m land use. The proposed boundary—a threshold the transgression of which would lead to major ecosystem disruptions globally—is 15 percent of ice-free land converted to agriculture uses. The current status of land converted for agriculture worldwide is 12 percent.[30]

Aerosol atmospheric loading with soot, sulfates, and other particles is viewed as a global process posing a potential planetary boundary, but due to its complexity (and problems of measurement) a safe boundary has not been designated. Aerosols both influence the climate system and have an adverse effect on human health. The global concentration of most aerosols has doubled since preindustrial times. Aerosols affect the Earth's radiation balance by scattering incoming radiation back into space or indirectly affecting cloud reflectivity and balance. Aerosols have thus played a role in tempering climate change. They also influence the hydrological cycle and may have a substantial effect on monsoons. The negative effects of aerosols on human health are substantial, resulting annually in some 800,000 premature deaths.[31]

Scientists working on planetary boundaries have not yet determined a boundary for chemical pollution due to the numerous, complex issues involved, and the vast quantity of synthetic chemicals in use, which number in the tens of thousands (without counting all the possible combinations in which these chemicals interact in the environment, which are astronomical in number). Nevertheless, it is clear that the spread of chemical pollution in the form of radioactive compounds, heavy metals, and a wide range of organic compounds introduced by industry represents a threat to biodiversity, to human life, and interacts in complex ways with other global environmental stresses such as climate change.[32] Some of these chemical pollutants, such as the metal mercury, go up smokestacks to later fall and contaminate soil and water, while others are leached into surface waters from waste storage facilities.

Many ocean and freshwater fish are contaminated with mercury, as well as numerous industrial organic chemicals. The oceans contain large "islands" of trash of various kinds, though predominantly plastics, the product of the petrochemical industry. "Light bulbs, bottle caps, toothbrushes, Popsicle sticks and tiny pieces of plastic, each the size of a gram of rice, inhabit the Pacific garbage patch, an area of widely dispersed trash that doubles in size every decade and is now believed to be roughly twice the size of Texas."[33] Sunlight and warm temperatures partially degrade the massive amount of plastic in the oceans into ever-smaller particles. There is so much of this material in the seas that "a handful of sand or cup of sea water from nearly anywhere in the world will probably be peppered with microplastics—pieces that are tinier than a small pea and often invisible."[34] These small pieces of plastic can harm small animals at the bottom of the food web as the plastic degrades within the organism and may do even more damage because it absorbs and concentrates toxic chemicals in the water.

In the United States, drinking water used by millions of people is polluted with pesticides such as atrazine, as well as nitrates and other contaminants of industrial agriculture. We are all contaminated by a variety of industrial and agricultural chemicals, and there is great concern about the health consequences. Agricultural pesticides are of special concern for people working with them or living in areas in which they are widely used. However, many foods we eat are also contaminated with pesticides. For example, more than half of the frozen blueberries and nearly half of the strawberries tested by the U.S. Department of Agriculture had detectable levels of a fungicide (boscalid); over half of the strawberries contained detectable levels of the fungicide captan; 50 percent of the grape juice tested contained the insecticide carbaryl; 75 percent of potatoes tested positive for the herbicide chlorpropham; about half of the green onions, collards, and kale tested positive for the herbicide DCPA; 40 percent of the sweet potatoes tested positive for the fungicide dicloran; almost 70 percent of broccoli tested positive for the insecticide imidaclo-pnd; and 40 percent of summer squash tested positive for the insecticide endosulphan. Some produce was contaminated with multiple chemicals. For example, from 20 to 100 percent of strawberries tested positive for each of sixteen different pesticides. And the list goes on and on.[35]

A survey of twenty physicians and nurses who were tested for sixty-two chemicals in blood and urine—mostly organic chemicals such as flame retardants and plasticizers—found that "each participant had at least 24 individual chemicals in their body, and two participants had a high of 39 chemicals detected.... All participants had bisphenol A" (BPA), a suspected

carcinogen, used to make rigid polycarbonate plastics used in water cooler bottles, baby bottles, linings of most metal food containers—and present in the foods inside these containers, kitchen appliances, and the thermal paper receipts people receive from supermarkets, automatic teller machines, gas stations, etc. Likewise each had: (1) some form of phthalates, found in many consumer products such as hair sprays, cosmetics, plastic products, and wood finishers; (2) PBDEs (polybrommated diphenyl ethers), used as flame retardants in computers, furniture, mattresses, and medical equipment; and (3) PFCs (perfluormated compounds), used in non-stick pans, protective coatings for carpets, paper coatings, etc.[36]

Although physicians and nurses are routinely exposed to larger quantities of certain chemicals than the general public, we are all exposed to these and other chemicals that don't belong in our bodies, and that most likely have negative effects on human health. Some 93 percent of people in the United States have BPA byproducts in their urine. Almost all people in the United States have detectable levels of PBDEs in their bodies. These chemicals have been shown to have negative neurological and fertility effects in animals and may lower fertility in humans as well.[37] There is significant concern that chemical contamination of fetuses during pregnancy is contributing to the rise of autism in children.[38] There also appears to be a link between organopliosphate pesticides and the development of Attention-Deficit/Hyperactivity Disorder (ADHD) in children.[39]

There are more than 80,000 chemicals in commercial use in the United States, and we do not know the composition and potential harmfulness of about 20,000 of them—their composition falls under the category of "trade secrets" and is legally withheld.[40] According to an editorial in *Scientific American,* "Of the more than 80,000 chemicals in use in the U.S., only five have been either restricted or banned. Not 5 percent, *five.* The EPA has been able to force health and safety testing for only around 200."[4]i At the end of March 2010, the U.S. Environmental Protection Agency finally listed BPA as a "chemical of concern," meaning that the agency will *commence* studying it.[42] The United States continues to have one of the worst records among industrialized countries concerning protection of its citizens from toxic chemicals found in products in everyday use—from cosmetics to food containers to denture cream (containing zinc that has caused toxicity in users). The use of untested and unregulated chemicals might change in the future, but not because of a change of heart by the business community regarding the poisons in their products. "The chemical industry seems less opposed to a regulatory overhaul [than in the past], in part because lax regulation may help low-cost Chinese chemical companies more than American firms."[43]

The President's Cancer Panel, in its 2010 report, summarized the situation as follows:

> A growing body of research documents myriad established and suspected environmental factors linked to genetic, immune, and endocrine dysfunction that can lead to cancer and other diseases. . . . Weak laws and regulations, inefficient enforcement, regulatory complexity, and fragmented authority allow avoidable exposures to known or suspected cancer-causing and cancer-promoting agents to continue and proliferate in the workplace and the community.[44]

It is beyond debate that the ecology of Earth—including the life support systems on which humans arid all other species depend—is under sustained and severe attack by human activities. It is also clear that if we don't radically change our ways, the results will be devastating. The multifaceted, complex, and rapidly accelerating character of the planetary environmental crisis is traceable to a single systemic cause: the economic and social order in which we live. The principal cause of ecological degradation, insisted Rachel Carson, author of the classic work *Silent Spring,* which sparked the modern environmental movement, is a society that worships "the gods of speed and quantity, and of the quick and easy profit, and out of this idolatry monstrous evils have arisen."[45]

## Chapter 5
## Can Capitalism Go Green?

> The most obvious way out [of the climate crisis] is a new round of growth—a giant burst of economic activity designed to replace our fossil-fuel system with something else that will let us go on living just as we do now (or better!), but without the carbon. Even, or especially, as our economy has tanked, we've seized on the idea of green growth as the path out of all our troubles.
>
> —BILL McKIBBEN[1]

Some people who recognize the ecological and social problems that capitalism brings still think that capitalism can and should be reformed. According to Benjamin Barber: "The struggle for the soul of capitalism is ... a struggle between the nation's economic body and its civic soul: a struggle to put capitalism in its proper place, where it serves our nature and needs rather than manipulating and fabricating whims and wants. Saving capitalism means bringing it into harmony with spirit—with prudence, pluralism and those 'things of the public'... that define our civic souls. A revolution of the spirit."[2] William Greider has written a book entitled *The Soul of Capitalism: Opening Paths to a Moral Economy.* There are books that tout the potential of "green capitalism" and the *Natural Capitalism* of Paul Hawken, Amory Lovins, and L. Hunter Lovins. *Green to Gold.,* a book by Daniel Esty and Andrew Winston—"printed on acid-free paper made from 100% postconsumer recycled pulp with soy ink"—is subtitled *How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage*.[3] So we can get rich, continue growing the economy, increase consumption without end, and save the planet—all at the same time! How good can it get?

There is, however, a big problem with such thinking. A system that has only one goal, the maximization of profits in an endless quest for the accumulation of capital on an ever-expanding scale, and which thus seeks to transform every single thing on earth into a commodity *with a price,* is a system that is soulless; it can never have a soul, never be green. It can never stand still, but is driven to manipulate and fabricate whims and wants in order to grow and sell more . . . forever. Nothing is allowed to stand in its path.

There are a number of important "out of the box" ecological and environmental thinkers and doers who are highly critical of the status quo and identify with the environmental resistance to the system, but who have nevertheless found ingenious ways to reconcile themselves with capitalism. For example, Hawken and the Lovinses argue that capitalism is not really capitalism unless it fully embraces so-called "natural capital," which means that all will be well if capitalism internalizes everything in nature, bringing the external world under its laws, reducing everything in existence to the status of a commodity—with a price. Consequently, these seemingly nonconformist environmental thinkers do not differ much from a more establishment figure like Al Gore, with his aspirations for a "sustainable capitalism."[4]

Hawken and the Lovinses and many others in the broad tradition they represent—people seeking progressive solutions but finding it impossible to get out of the capitalist framework—are no doubt genuinely good and well-meaning people who are sincerely concerned with the health of the planet. Most are also concerned with issues of social justice. Some truly admirable figures like Wes Jackson and Wendell Berry are working toward concrete low-tech solutions, emphasizing local sustainability arid community, while understanding that there is no real silver bullet cure for what ails the planet. We ourselves have been inspired at times by the ideas of such out-of-the- box thinkers.

But there is one box from which it is impossible to escape without confronting it directly: the capitalist economic system. Many, if not most, influential environmental thinkers in the world's rich countries still shy away from such a direct confrontation. Even the increasing numbers of

green thinkers who criticize capitalism and its market failures, frequently settle in the end for what they regard as practical solutions directed at creating a tightly controlled humane, green, and non-corporate capitalism, instead of actually getting outside the box of capitalism. Some call for reinventing "the purpose and design of business," or using tax policy to better direct investment and consumption to green ends, or for trade policies that might promote the goods of more sustainable economies.[5] Others suggest eliminating the myriad government subsidies to businesses and taking into account social and ecological consequences of production ("externalities") so as to give rise to "honest prices" that reflect the real costs, including those to the environment.[6] The contradictions and complexities of actually implementing a new way to price commodities, in a system in which the profit is the only god, and power rests in the hands of people who have no interest in doing this, makes all of this an insurmountable task. As David Harvey has said: "If capitalism is forced to internalize" all of the social and environmental costs it generates "it will go out of business. This is the simple truth."[7]

**The Mystique of the Market**

The remedies proposed by environmental reformers often include maintaining a strong role for private ownership of businesses as well as the role of markets. In many people's minds markets (especially so-called free markets) are an important positive aspect of capitalism because they provide cues telling business-people what to invest in, and whether more or less of some product or service should be produced. Markets are also, in this view, the only efficient way of distributing goods. Thus markets are supposed to make sure that what's needed gets produced and what people don't need or want doesn't get produced.

Such claims with regard to market efficiency are frequently based on mystical notions of what markets are—and what the market system is. Indeed, much of this has its basis in a form of circular reasoning: market prices are described as efficient, while efficiency itself is whatever arises from a system of market prices. Widespread market inefficiencies and market failures are downplayed as peripheral issues no matter how pervasive. Negative effects, resulting from the externalization of costs on people and the environment, are often ignored even if they threaten the existence of most human beings and the planet itself.[8] The fact that markets in a capitalist society serve the narrow interest of the accumulation of capital and reinforce the power of the wealthy is frequently hidden, since the power relations that lie behind most real markets are not transparent. Often we are told that markets should be self-regulating, and hence "free," which means governments should riot intervene. Yet, markets in the real world are dominated by giant corporations, which intervene in numerous ways in their functioning, employing enormous monopoly power. Indeed, economists commonly speak of the *market power* of such giant corporations, in order to refer to their *monopoly power over the market.*

Most discussions of markets ignore not only corporate power but also class power and other forms of social and economic inequality. Market economies are mystifying in that they disguise these vastly unequal relations, generating results that appear accidental—the violence of things rather than the violence of property.[9] The "highest and best use" of a resource or a commodity in a market system is not what benefits the population as a whole, but what benefits those with the greatest purchasing power.

The neoliberal idea of the smoothly operating and efficient self-regulating market society—nothing more than a self-serving myth—dominates much of current policy, and is used to beat down any barriers to economic interests.[10] Rather than a self-regulating market, what we increasingly have today is a society in which private interests increasingly *regulate the state.* For example, in the financial crisis of 2007-2009 the first priority of all of the mature capitalist states was to bail out big capital and big finance, to the tune of trillions of dollars. The population was simply told that the market demanded it, since certain firms were "too big to fail." At the same

time that the riches of the wealthiest members of society were being preserved millions of people lost their homes and jobs and slipped into poverty.

The whole notion of the market has become so abstract, and so removed from reality in every way, as economist James K. Galbraith has stated, that "when you come down to it, the word market is a *negation.* It is a word to be applied to the context of any transaction so long as that transaction is not directly dictated by the state."[11]

### The Neoliberal Concept of Democracy

The commonplace notion of the opposition between state and market, between public and private, is important. The state represents the realm of political action, in which democracy—the rule of the people, by the people, and for the people—is theoretically possible. In contrast, the market under capitalism represents the rule of capital, by capital, and for capital.

Today, rather than a true democracy we have a plutocracy (rule by moneyed interests) in which some of the formal elements of democracy nonetheless remain. Needless to say a real democracy, as this was classically understood in egalitarian terms, is impossible where income, wealth, and power are concentrated and where inequality is growing, that is, in the normal way of things under capitalism. Hence, ever since the publication in 1942 of Joseph Schumpeter's *Capitalism, Socialism, and Democracy,* in which the neoliberal concept of democracy as a market relationship was first introduced, attempts have been made by defenders of the system to redefine "democracy" in economic terms, transforming it into something nearly opposite its original meaning. In ancient Greece democracy was associated with the rule of the *demos,* i.e., the common people. In contrast, democracy has now been redefined in the United States and some other countries as a system in which individuals simply vote periodically for political entrepreneurs, who seek out their votes much like commercial interests seek out dollars in the marketplace.[12] The essential content of democracy has therefore been eviscerated. So politically corrupted is the U.S. political system that instead of one person, one vote being the rule, an individual's political influence is weighted according to his/her wealth, which determines how responsive politicians are to that individual's interests. Big money, as is well known, provides access to politicians and opens doors. At the same time, corporations themselves "vote" with their dollars, feeding the financial campaign chests of politicians and hiring a phalanx of lobbyists to forward their interests. Politicians frequently end up paying their financial donors back "with interest" for what they receive. As in any business transaction, corporations provide political campaign financing and naturally expect "value added" in return.[13]

### The Inversion of the Real

The capitalist system, since it worships what Rachel Carson called "the gods of profit and production" rather than real needs, is unable to supply all people with the essential requirements of a decent life, or, in some cases, life itself.[14] This derives from the fact that capitalism is inherently an alienated system, in which those on the receiving end of the system measure themselves by their distance not only from the rest of the world's population but also from nature itself, glorying in the "conquest of nature." It is a world turned upside down: one that places abstract value above human beings, making it, and not the living, creative forces of nature and humanity, the measure of what is material and productive.

It follows that the various ways of "reforming" capitalism that are promoted by often well-meaning, practical people, who are trying to change things within the parameters of what is allowed by the system, are little more than intellectual contortions: people trying to get around or smooth over basic features of the system because in their eyes a real alternative is unthinkable. In what Derrick Jensen and Aric McBay call the "inversion of what is real," capitalism is seen as

more real than the environment; and hence it is capitalism that needs to be saved in the context of the environmental crisis, as opposed to the earth's environment itself.[15]

Not surprisingly, then, the dominant strategies with respect to global warming to be found in environmental circles are concerned not with preserving the planet but with preserving capitalism, the very system that is destroying the earth as we know it. In a speech calling for "urgent action to fight global warming," UN Secretary General Ban Ki-moon said: "We must be actively engaged in confronting the global challenge of climate change, which is a serious threat to development everywhere."[16] In this view, it is not capitalist development, that, by promoting global warming, constitutes a threat to the earth's environment and its inhabitants, but rather global warming that constitutes a threat to capitalist development. What nearly all mainstream solutions to the global environmental problem have in common, as Jensen and McBay write, is that

> they all take industrial capitalism as a given, as that which *must* be saved, as that which must be maintained at all costs (including the murder of the planet, the murder of all that is real), as the independent variable, as primary; and they take the real, physical world—filled with real physical beings who live, die, make the world more diverse—as secondary, as a dependent variable, as something (never someone, of course) that (never who) must conform to industrial capitalism or die. . . . Within this culture, the *world* is consistently less important than *industrial capitalism, the end of the world is* less to be feared than the *end of industrial capitalism.*[17]

The "out of the box" environmental thinkers, who often parade as the most radical and critical green thinkers, but who all too often fall prey to the mystique of capital, are thus unable even to envision, let alone promote, an economic system that has fundamentally different goals and decision-making processes than those that are currently dominant. As cultural theorist Fredric Jameson has said, for many people in this society, "it is easier to imagine the end of the world than to imagine the end of capitalism."[18]

**The Morality of "Green Capitalism"**

Today green is good. "Being green" has become very fashionable as well as profitable, and corporations are outdoing each other to portray themselves as green and socially responsible. After all, who doesn't want to be considered sustainable? You can buy and wear your Gucci clothes with a clean conscience because the company is helping to protect rain forests by using less paper.[19] *Newsweek* claimed that corporate giants such as Hewlett-Packard, Dell, Johnson & Johnson, Intel, and IBM were the top five green companies of 2009. This was because of their use of renewable sources of energy, their reporting of greenhouse gas emissions (or their lowering of them), and their implementation of formal environmental policies.[20] Some environmentalists and business leaders say that you should "vote with your wallet," by purchasing green products. Environmental problems can be and in some cases are being ameliorated by better production practices (for example, growing organic food or using renewable inputs instead of nonre-newable ones). The business offensive along these lines just prior to the Copenhagen Climate Change meeting was described by the *Guardian* (UK): "Climate change catastrophe can be averted by 'greening' consumer behaviour rather than by curbing economic growth and mass consumerism, leaders of some of the world's biggest businesses including Tesco, Coca-Cola and Reckitt Benckiser argued today."[21]

The mainstream emphasis on corporate responsibility as the solution to the environmental problem can be examined by looking at the case of BP. On April 22, 1999, Sir John Browne, CEO of BP, received an award for Individual Environmental Leadership from the UN Environmental Programme for his leadership in promoting environmental causes. Under

Browne's leadership BP had adopted the slogan "Beyond Petroleum," and had acknowledged that greenhouse gases might cause global warming. In 2000 Browne was also awarded *FIRST Magazine's* FIRST Award for Responsible Capitalism for his advances in social responsibility. Browne and BP became symbols of a new green corporate world. "Can business be about more than profits? We think it can"—went a Browne-inspired BP ad. Browne promised growth with environmental cleanliness. Browne was a leading advocate of the "precautionary principle," in which business would refrain from economic activities that might *be* environmentally destructive.[22]

However, despite BP's "Beyond Petroleum" slogan the company continued its aggressive expansion of oil drilling, even in environmentally sensitive and hazardous areas, such as the Arctic Circle and the deep ocean. Browne argued that there was no conflict between green values and cars that emphasized performance over fuel efficiency. Nor, he insisted, was BP's opposition to government regulation with regard to the environment a contradiction, since socially responsible corporations would police themselves.[23] Under Browne's leadership BP entered an era of extreme cost cutting with regard to safety, which generated greater profits but also greater environmental hazards.

In March 2005 fifteen workers were killed and another 180 injured in chemical fires and explosions at BP's plant in Texas City—later shown to be the fault of drastic cuts in safety personnel.[24] Although Browne resigned as CEO of BP in 2007, BP's practice of putting profits before safety and the environment continued, leading to the Deepwater Horizon oil spill in 2010, after an explosion that killed eleven workers. Oil flowed for three months into the Gulf of Mexico, in the biggest accidental marine oil spill in the history of the oil industry. The spill itself was the result of numerous, egregious reductions in safety standards by BP, associated with a business culture of cost cutting to improve its bottom line.[25]

The fact that BP's celebrated status as a leading "green" company was shown to be mere corporate "greenwashing" should of course hardly surprise us. When noted conservative economist Milton Friedman was asked in 2004 whether John Browne as CEO could go so far with his supposed green convictions as to sacrifice BP's economic interests, Friedman flatly answered: "No. . . . He can do it with his own money. [But] if he pursues those environmental interests in such a way as to run the corporation less effectively for its stockholders, then I think he's being immoral. He's an employee of the stockholders, however elevated his position may appear to be. As such, he has a very strong moral responsibility to them."[26] In other words, it is the fiduciary responsibility of any CEO to pursue the highest profits or the maximum increase in stockholders' equity. If a CEO were so deluded as to think that other values could in some way intrude upon this objective, such that profits would be diminished—say by an oil company cutting back on its drilling or by putting safety and the environment first—then that CEO would soon be out of a job. Quite clearly, John Browne knew the corporate bottom line in this respect, and never let his talk about environmental values and corporate social responsibility interfere with BP's real, exploitative relation to the environment.

The corporate green movement has also reached into consumption, leading to endless hype on "green consumers" and "green markets." All the emphasis in media stories and advertising on sustainable consumption has created would-be green consumers, who feel that by purchasing "sustainable" commodities they can pursue their same consumerist lifestyles and feel virtuous at the same time. However, many so-called green products have been shown to be no better for the environment than their non-green counterparts.[27] As environmentalist Heather Rogers informs us:

> What I learned [while doing research for *Green Gone Wrong]* is that the outcome of industrial organic [food], commodity biofuels, and $CO_2$ offsetting isn't authentic protection and stewardship of the environment. What's transpiring is a tailoring of environmental

> crises so they can be dealt with in ways today's economic and political structures deem least threatening to the status quo.[28]

The Corporate Social Responsibility (CSR) programs, although supported by some genuinely concerned individuals, have mainly become marketing opportunities, and somewhat successful as such:

> Companies use CSR programs to build brand loyalty and make personal connections with customers. There can be a payoff: 70 percent of consumers say they would pay a premium for goods from socially responsible companies, according to a recent poll of 1,001 adults.... Of that group, 28 percent said they would pay at least $ 10 more for a product because of the social responsibility link.[29]

An expert consultant on issues such as "social responsibility" has some doubts about it: "There's often more spin than substance when it comes to social responsibility.... Companies want to take credit for things that they ought to be doing anyway."[30] One of the companies leading the movement, as we have seen, has been BP, one of the least socially responsible companies on Earth. But BP's obfuscating propaganda was effective as indicated by its stock being held in the portfolios of a number of "socially responsible" mutual funds.[31]

Today, mainstream environmentalists, oddly enough, look to Wal-Mart as the leader in corporate responsibility and green business. Thus Wal-Mart, the world's largest corporation in 2009, is celebrated in the Worldwatch Institute's *State of the World, 2010* report as the firm that best exemplifies the move from an exclusive focus on profits to a sustainable business model as its "primary fiduciary responsibility." Former Wal-Mart CEO (now board chairman) Lee Scott is quoted as committing the company in 2005 to "100 percent renewable energy, to create zero waste" (while at the same time admitting he had no idea how Wal-Mart can achieve such goals). We are told that Wal-Mart is now on a "sustainable journey" (at little cost to itself), promoting green values among all of its 1.4 million U.S. employees, who are encouraged to be more sustainable consumers, recycling and eating more healthy meals. Among its other measures, Wal-Mart has pledged to market only wild-caught fish certified by the Marine Stewardship Council (an organization viewed dubiously by Food and Water Watch and by many environmentalists). Its chief concrete environmental commitment, made in 2005, was to become 20 percent more energy efficient by 2013 through cutting the carbon emissions associated with its current stores by 2.5 million metric tons. But by 2006 Wal-Mart's carbon emissions had already risen, by its own admission, another 9 percent. The new stores that were being added in 2007 alone were expected to consume enough electricity to add one million metric tons to its overall greenhouse emissions, exceeding any efficiency gains. As Wes Jackson put it, "When the Wal-Marts of the world say they're going to put in different lightbulbs and get their trucks to get by on half the fuel, what are they going to do with the savings? They're going to open up another box store somewhere. It's just nuts." In the end, Wal-Mart is an economic juggernaut—anything but representative of a new, sustainable economic order.[32] It is known especially for its harsh policies toward labor and its readiness to go to virtually any length (including closing down stores) to prevent the unionization of its workers.

The reality is that none of the proposals for reforming capitalism deal with the essential issue, the bottom line of net gain or profit. For the sake of the environment and our future as a species, the economy cannot keep growing forever with more and more goods and services (green or not) consumed per person. But if the economy doesn't grow, how are jobs going to be created and maintained? Experience has shown that slow or no growth in a capitalist economy is a disaster for working people.

## Is Reversing Global Climate Change Compatible with Capitalism?

Let's put aside corporate greenwashing efforts, the systemic imperative to growth and environmental exploitation, and the question of the role of technology under capitalism and take a look at some of the proposed technical ways to deal with global climate change—currently the most critical problem facing the earth and its inhabitants—without disturbing capitalism.

### Technologies That Are More Energy Efficient, Less Harmful, and/or Use Fewer Material Inputs

Some proposals to enhance energy efficiency—such as helping people tighten up and insulate their old homes so that less fuel is required for winter heating, and the use of simple rooftop solar water heaters—are just plain common sense. Machinery, including household appliances and automobiles, is continually becoming more energy efficient—a normal part of the system, sometimes coaxed by government regulations. Nevertheless, it is important to note that increased energy efficiency usually leads to lower costs of use, but also increased use, and often increased size as well, as in automobiles and refrigerators—so that the amount of energy used is frequently increased, or the energy savings are less than they would be if product size remained the same. People may drive their fuel-efficient Toyota Prius more miles and leave on the efficient LED lighting more hours than with more energy-consuming technologies. They may think that they are doing the earth a favor by buying hybrid SUVs that are more fuel-efficient than non-hybrids, but still use a lot more fuel than a smaller vehicle.

There are proposals to provide less polluting technologies, particularly solar, wind, and water power. It is certainly true that this is the way to go in generating energy, as opposed to fossil fuels, agrofuels, or nuclear energy. There is also the possibility of combining hydropower with either wind or solar power by pumping water uphill during the day when energy from wind and solar are available and then allowing the water to return through turbines, generating electricity at night if needed. But these sources of energy do not provide a free lunch with respect to the environment, and hence do not allow for unlimited economic expansion without cost. They frequently come with their own problems. There is renewed interest in hydropower, especially in smaller-scale projects—although large-scale projects continue to be developed in Asia and South America. The damage to the environment and to humans caused by large dams—forests inundated, species destroyed, seawater intrusion and the killing off of mangroves in deltas, and relocation of indigenous peoples—has generated a movement to try to stop such projects.

The earth's geothermal energy can be safely developed in some areas (Iceland has done quite a bit with this source of energy) and holds promise, although appropriate locations are difficult to find and drilling for such projects in northern California and Switzerland triggered earthquakes.[33] Resource extraction needed for some of the "clean" technologies, such as the rare earths required for wind electric generators and hybrid car batteries, come with their own environmental issues.[34]

While some of the proposals make sense, the misguided push to "green" agrofuels (biofuels made from agricultural crops such as corn, soybeans, rapeseed, and palm oil) has been enormously detrimental to the environment and people. The idea is to replace oil-derived gasoline and diesel by producing the, liquid fuels ethanol and biodiesel from farmed crops. Not only has the growth of the agrofuel industry put food and auto fuel in direct competition, pushing food prices higher, but the production of agrofuels also sometimes actually uses more energy to grow and transport and process the crop than the energy obtained. In addition, significant air and water pollution is frequently associated with the growing and processing of crops for liquid fuels.[35]

Tropical forests are being cut down to plant oil palms, to supply oil to produce biodiesel (in addition to its customary use as a cooking oil and in cosmetics), resulting in displacement of indigenous peoples and massive emissions of $CO_2$ as trees are burned and soils disturbed. Conversion of forests to produce oil palm to make "green" biodiesel ends up increasing CO., emissions, even in the fairly long term. It is estimated that it will take four hundred years of diesel production of palm oil from these plantations to "pay hack" the environment for the $CO_2$ emissions occurring during preparation and planting of oil palm trees.

Another idea for producing "green" liquid fuels is to convert plant cellulose to alcohol, although it is not yet economically feasible to do so. One of the potential materials, the crop "waste," considered to be one of the important feedstocks for this endeavor, is not waste at all. The return to the soil of crop residues is essential for maintaining organic matter, which has such positive effects on crop yields. Another avenue being explored is the use of algae that make oil. However, this has its own potential problems such as the amount of land needed and the possibility that genetically modified algae will be used, with unknown consequences if they escape into the environment.

Instead of rethinking the entire system as environmental problems develop, people look for silver bullets—-technologies such as agrofuels that will "solve" the problem. However, it is not uncommon to discover later that the silver bullet itself causes other problems. For example, in order to find a replacement for ozone-depleting chemicals used in refrigerators and air conditioners as well as insulating foam, HFCs (hydrofluorocarbons) were introduced as a substitute in the 1990s.[36] Though this did help the protective ozone layer recover, HFCs turn out to have over 4,000 times the heat-trapping ability of $CO_2$, thus worsening global warming. The increase in atmospheric HFCs from leakage from junked refrigerators and air conditioners is projected to be large enough by 2050 to account for six years' worth of $CO_2$ emissions.

There are technologies that allow for some kind of conservation, lessening the throughput of resources and energy, generating less waste, reducing toxins, etc. But increased efficiency in the use of energy and resources tends, as we have seen, to result in the expansion of the capitalist economic system as a whole, negating any reductions in energy and resource use per unit of output. This is known as the Jevons Paradox, after nineteenth-century economist William Stanley Jevons, who first raised the issue in his book *The Coal Question.* Jevons pointed out that every new steam engine was more efficient in its use of coal than the one before, and yet the introduction of each more efficient engine led to the consumption of greater amounts of coal due to the expansion of production. The Jevons Paradox is now widely recognized by environmentalists as a key reason why technology alone—outside the transformation of social relations—cannot solve the ecological contradictions of capitalism.[37] As philosopher Hannah Arendt put it in *The Human Condition:* "Under modern conditions, not destruction but conservation spells rum because the very durability of conserved objects is the greatest impediment to the turnover process [of capital], whose constant gam in speed is the only constancy left wherever it has taken hold."[38]

### High-Tech / High-Risk Solutions

The fact that accumulation is the single drumbeat -of capitalist society means that ecological systems, and the biological-health systems of species, are stretched to the limits, leading to ever-increasing risk. This has led sociologists to speak of the emergence of a "risk society," as a product of capitalism and modernity.[39] Toxic chemicals, radiation, and other hazards pervade our environment and our bodies, with no attempt to discern the full effects—or even to test most of the chemicals, despite their frequent carcinogenic, teratogenic, and mutagenic effects. It is enough for the system that such technologies are useful in expanding the economy at low cost to business. The consequences are dealt with in terms of so-called risk management, attempting to discern (while underestimating and playing down) the number of deaths per million

that constitute "acceptable risk."[40] In a society organized in this way it is natural enough to respond to the threat to the planet represented by global warming by turning to riskier and riskier technologies, continually upping the general level of risk. Where "progress" is confused with higher profit margins, which often means the willingness to take on greater risk, such a solution may even seem rational.

The risk-society issue is immediately evident when the question of nuclear power as a solution to global warming arises. Some scientists concerned with climate change, including James Lovelock and James Hansen, see nuclear power as an energy alternative and as a partial technological answer to the use of fossil fuels—one that is much preferable to the growing use of coal. However, nuclear energy at present releases 9 to 25 times the carbon emissions of wind energy, due to uranium refining, transport, and reactor construction. Although the technology of nuclear energy has improved somewhat with third-generation nuclear plants, and although there is now the possibility (still not a reality) of fourth-generation nuclear energy, the dangers of nuclear power are still enormous—given radioactive waste lasting hundreds and thousands of years, the social management of complex systems, and the sheer level of risk involved. The 2011 post earthquake/tsunami disaster at Japan's Fukushima Dai-Ichi facility once again illustrates the ongoing dangers and immense risks associated with dependence on nuclear power.

The breeder nuclear reactor—a third-generation nuclear technology currently available and often presented as an alternative— has similar problems to those of conventional fission reactors, though producing less low-level radioactive waste and able to reuse the spent fuel, thereby alleviating the problem of limited uranium reserves. However, they also generate nuclear materials closer to weapons grade that can be more readily reprocessed for nuclear weapons. This close connection between nuclear power and nuclear weapons development is of course a major concern for all humanity.

Nuclear plants take about ten years to build and are extremely costly and uneconomic. It has been estimated that to satisfy the world's electrical power demands through nuclear energy it would require building a nuclear power plant every day for the next forty three years. If a mere 5 percent of these were built it would double the world's current nuclear power installations worldwide. The result would be an increased likelihood of what sociologist Charles Perrow has called "normal accidents," as these extremely high-risk facilities proliferate. There are all sorts of reasons, therefore, to be extremely wary of nuclear power as any kind of environmental solution. To go in that direction would clearly be a Faustian bargain.[41]

A number of vast geoengineering schemes have been proposed either to take $CO_2$ out of the atmosphere or to increase the reflectance of sunlight back into space, away from Earth. These include:

- Finding ways of absorbing carbon more effectively, such as fertilizing the oceans with iron to stimulate algal growth to absorb carbon, and reforesting the planet with genetically altered fast-growing trees.

- Various proposals to decrease solar energy absorbed by the Earth by means of enhanced sunlight reflection schemes, such as deploying huge white islands in the oceans to restore the albedo effect; creating large satellites to reflect incoming sunlight; contaminating the stratosphere with sulfur dioxide particles that reflect light and promote global dimming.

- Geoengineering carbon sequestration on a massive scale. Here the assumption is that physics and economics will allow the capture of carbon, and the use of large machines distributed around the world will make it possible to scrub $CO_2$ from the atmosphere itself instead of from individual industrial plant emissions. After trapping $CO_2$ on an adsorbing material, it would then be liquefied for disposal.[42]

No one knows what detrimental side effects might occur from such huge schemes—attempts to play God with the planet. The sheer complexity of the problems raised suggests the enormous, planetary-risk nature of such ventures. For example, stimulating algal growth by applying iron to oceans might just lead to more "dead zones" when the algae die and fall to the lower depths, harming other aquatic life. Dumping sulfur dioxide into the stratosphere to block sunlight could reduce photosynthesis throughout the planet.

**"Clean Coal"**

One common technological solution proposed is the shift to what is referred to as "clean coal" as a way of expanding the production of fossil fuels—but without carbon emissions. The U.S. government has poured billions of dollars into supporting such clean coal research. Although clean coal is not a reality (and never can be), the mere idea is used to defend continued coal production and the building of more dirty coal plants. The clean-coal technology claim is based on what is called carbon capture arid storage (CCS) technology. This technology is designed to remove carbon from the air prior to its being released into the atmosphere and turn it into a non-harmful substance that can be injected into geological formations or into the ocean. Even the most optimistic scenarios, however, do not see CCS technology as available until 2030—way too late to deal with the immediate climate change problem. The technology, while nascent, has never been used on an industrial scale. Moreover, it carries with it enormous economic costs—with price increases from the implementation of CCS technology estimated to be in the range of 21 to 91 percent. The fuel needs of plants employing CCS technology are expected to go up by 25 percent. A May 2011 report by the American Physical Society on the physics of DAC (direct air capture) of carbon dioxide concluded:

> With optimistic assumptions about some important technical parameters, the cost of this system is estimated to be of the order of $600 or more per metric ton of $CO_2$. Significant uncertainties in the process parameters result in a wide, asymmetric range associated with this estimate, with higher values being more likely than lower ones. Thus, DAC is not currently an economically viable approach to mitigating climate change . . . Since a 1000-megawatt coal power plant emits about six million metric tons of $CO_2$ per year, a DAC system consisting of structures 10 meters high that removes $CO_2$ from the atmosphere as fast as this coal plant emits $CO_2$ would require structures whose total length would be about 30 kilometers. Large quantities of construction materials and chemicals would be required. It is likely that the full cost of the benchmark DAC system scaled to capture six million metric tons of $CO_2$ per year would be much higher than alternative strategies providing equivalent decarbonized electricity.[43]

The injection of captured carbon into the ocean could increase the acidity of the ocean with consequences potentially as large as climate change itself. The ramifications of attempting to store the captured carbon dioxide in geological formations is still uncertain, though it is clear that the escape of large amounts of the gas could be dangerous (residents near an African lake were suffocated in 1986 when a natural pocket of carbon dioxide escaped). For all of these reasons, clean coal is largely a hoax. The real priority, as James Hansen indicates, is to stop building new coal plants and to retire those that exist. If the coal reserves are burned climate change will become unstoppable and catastrophic. CCS technology also does not address the many other environmental damages caused by coal production and coal plants: mountaintop removal, long-wall mining, plus all the mercury, arsenic, sulfates, and other air and water pollutants that come with the coal system.[44]

### Low-Tech Solutions

Also proposed are a number of low-tech ways to sequester carbon such as increasing reforestation and using ecological soil management to increase soil organic matter (which is composed mainly of carbon). Most of the management techniques for increasing soil organic matter—use of cover crops, return of crop residue to the soil, integrating livestock and crop farming once again, and using better crop rotations—should be done for their own sake because organic material helps to improve soils in many ways. As agricultural soil organic matter content increases and forests grow (and the soil underneath the forest also increases in organic matter), this keeps at least some $CO_2$ out of the atmosphere. Thus reforestation, by pulling carbon from the atmosphere, is sometimes thought of as constituting negative emissions.

Another scheme for increasing stored carbon in the soil is to incorporate "biochar," the product of relatively low temperature burning with limited oxygen. This char is very stable and is believed to be one of the factors responsible for the maintenance of soil fertility in long abandoned fields in the Amazon basin (these dark soils are referred to as *terra preta de indio).* However, forests must be cut down to produce large quantities of biochar, and croplands will have to be used to grow residue to burn—and about half of the carbon contained in these materials will end up in the atmosphere during the combustion process.

Some low-tech solutions may help, but obviously cannot solve the problem given an expanding economic system, especially since trees planted now take a long time to sequester meaningful amounts of carbon, can be cut down later, and carbon stored as soil organic matter may later be converted to $CO_2$ if practices are changed. However, if practiced, widely increasing soil organic matter might provide a temporary slowing down of the rate of increase of atmospheric $CO_2$.

### Cap-and-Trade and Other Market Schemes

Government regulation of polluting industries has worked to some extent and can in the future if the regulations address the actual problems and the regulators are not in bed with those being regulated, which, however, is the normal case in the present system. A struggle for increased government regulation with respect to the environment, particularly if structured to respond to the needs of the actual population as a result of constant public pressure, is a necessary immediate response to the environmental problem.

But many environmentalists, unable to imagine a non-capitalist economy, and responding to what they consider practical— that is, what the reigning economic interests are willing to accept—have endorsed market-based "solutions" to environmental problems. These run the gamut from paying businesses to be more ecologically sound (such as "green payments" for farmers to use practices that reduce soil erosion), to the heavy taxation of fossil fuel use, to giving or selling tradable rights to pollute after imposing a cap on emissions of the pollutant.

Until the last couple of years, the darling of market-oriented solutions to carbon emissions was "cap-and-trade." This involves placing a cap on the allowable level of greenhouse gas emissions and then distributing, either by fee or by auction, permits that allow industries to emit carbon dioxide and other greenhouse gases. Those corporations that have more permits than they need may sell them to other firms that want additional permits to pollute. Such schemes invariably include "offsets" that act like medieval indulgences, allowing corporations to continue to pollute as long as they buy good grace through helping to curtail pollution somewhere else, perhaps in the third world.

How did cap-and-trade, as opposed to taxing pollution or simply legally mandating reductions in emissions, go from a theory to a near consensus? According to a 2009 article in the *New York Times:*

> The answer is not to be found in the study of economics or environmental science, but in the realm where most policy debates are ultimately settled: politics. Many members of Congress remember the painful political lesson of 1993, when President Bill Clinton proposed a tax on all forms of energy, a plan that went down to defeat and helped take the Democratic majority in Congress down with it a year later. *Cap and trade, by contrast, is almost perfectly designed for the buying and selling of political support through the granting of valuable emissions permits to favor specific industries and even specific Congressional districts*.[45]

Cap-and-trade—originally proposed by conservatives for reducing sulfur dioxide (a significant contributor to acid rain) emissions from power plants—has gone out of favor in the United States as a response to carbon emissions because conservatives now claim it is a new tax, and some of the political liberals in Congress are aware of its failure in Europe. It is clear that this proposed solution is much less efficient than a straight tax or mandate for lowering pollution, partly because it tends to put a floor under existing emissions, partly because it promotes offsets that "reduce" emissions only on paper, not in reality.

In theory, carbon cap-arid-trade would stimulate technological innovation to increase energy arid commodity output per amount of carbon dioxide emitted. In practice, however, it has not led to carbon dioxide emission reductions in areas where it has been introduced, such as Europe. The main result of carbon trading has been enormous profits for some corporations and individuals and the creation of a subprime carbon market.[46]

Carbon offsets are invariably part of cap-arid-trade schemes but also can be stand-alone projects. You can now travel wherever you want, guilt-free, by purchasing carbon "offsets," such as having a few trees planted somewhere, and thus supposedly cancel out the environmental effects of your trip. The lack of verification and long-term commitment of these supposed offsets can result in fraudulent or poorly designed arid carried out projects that will not be enough to compensate truly for the $CO_2$ emitted and supposedly offset.[47] In addition, there are no prohibitions against changing conditions sometime in the future that will result in carbon dioxide release to the atmosphere.

Europe dominates the $144 billion a year (in 2009) greenhouse gas market. A primary offset purchased by many European companies has been for Chinese firms to destroy HFC-23, a by-product of producing the gas HFC-22, used as a refrigerant. One molecule of HFC-23 in the atmosphere has about ten thousand times the heat retention of one molecule of $CO_2$. It turns out that companies can make a lot of money destroying HFC-23. There is evidence that some plants in China have been producing more refrigerant than they can sell in order to have more HFC-23 that they can be paid to destroy.[48] About half of all offsets approved by the United Nations through the summer of 2010 are for credits for HFC-23 destruction. As Clare Perry of the Environmental Investigation Agency has stated, "It would be far cheaper and more effective to directly finance the factories to deal with the HFC-23 problem rather than use this kind of byzantine financing."[49]

For James Hansen cap-and-trade is the "temple of doom" arid "worse than nothing" because it prevents effective action directly limiting carbon through regulations and a properly designed tax, while giving people the impression that something is being done.[50] Indeed, the various technofixes discussed above associated with today's green technology and markets—more efficient and/or cleaner energy production arid use, better regulations, cap-and-trade of greenhouse gases, carbon offsets, etc.—are all roads to climate catastrophe rather than climate protection. "Green capitalism," even if products are produced using the utmost environmental care and designed for easy reuse, offers no way out of a system that must expand exponentially and thus, continue to ratchet up its use of natural resources, its chemical pollution, its contaminated sewage sludge, its garbage, and its many other toxic substances. Some of these

"fixes" will probably slow down the rate of environmental destruction, but the magnitude of the needed changes dwarfs these approaches.

Indeed, the problem with all of these approaches is that they allow the economy to continue on the same disastrous course it is currently following. The economy can keep on growing and we can go on consuming all we want (or as much as our income and wealth allow)—driving greater distances in our more fuel-efficient cars, living in very large but well-insulated homes, consuming all sorts of new products made by green corporations, and so on. All we need to do is support the new green technologies arid be "good" about separating out waste that can be composted or reused in some form, and we can go on living pretty much as before, in an economy of perpetual growth and profits.

**The Need for Sustainable Human Development**

The seriousness of the climate change problem arising from human-generated carbon dioxide and other greenhouse gas emissions has led to notions that it is merely necessary to reduce carbon footprints (a difficult problem in itself). The reality is that there are numerous, interrelated, and growing ecological problems arising from a system geared to the infinitely expanding accumulation of capital. What needs to be reduced is not just *carbon footprints* but *ecological footprints* which means that economic expansion on the world level and especially in the rich countries needs to be reduced, even cease. At the same time, many poor countries need to expand their economies, requiring an even bigger cut in the ecological footprints of rich economies to make room for development in the periphery.

The new principles we should promote under these circumstances are those of sustainable human development. This means *enough* for everyone and no more. Human development would certainly not be hindered, and could even be considerably enhanced, for the benefit of all by an emphasis on sustainable human, rather than unsustainable economic, development.[51]

A drastic transformation in global energy use—staying within the solar energy budget—will be required to overcome the problem of climate change. To give some idea of the incredible effort needed to keep global warming to *only 2* degrees C (3.6 degrees F) simply by technical means, about 80 percent of all of the energy used in the world (13 out of 16 trillion watts).would need to be replaced by $CO_2$-neutral technologies. According to a *New Yorker* article profiling inventor Saul Griffith, accomplishing this "would require building the equivalent of all the following: a hundred square metres of new-solar cells, fifty square metres of new solar-thermal reflectors, and one Olympic swimming pool's volume of genetically engineered algae (for biofuels) every second for the next twenty-five years; one three-hundred-foot-diameter wind turbine every five minutes; one hundred-megawatt geothermal-powered steam turbine every eight hours; and one three-gigawatt nuclear power plant every week."[52] All of this new construction would of course mean a huge, if temporary, increase in energy demands. Griffith has explained: "Everyone sees climate change as a problem in the domain of scientists and engineers.... But it's not enough to say that we need some nerds to invent a new energy source and some other nerds to figure out a carbon-sequestration technology—and you should be skeptical about either of those things actually happening. There are a lot of ideas out there, but nothing nearly as radical as the green-tech hype. We've been working on energy, as a society, for a few thousand years, and especially for the last two hundred years, so we've already turned over most of the stones."[53] Regardless of whether major advances in cleaner energy production are coming soon, the magnitude of the climate change problem calls for drastic reductions in energy use through conservation and alterations in lifestyle. This requires radical transformations in human priorities—not just placing one's hopes m technological fixes.

The reality is that the major environmental problems we face today—of which climate change is only one—cannot be solved by means of technological or market-based solutions while keeping existing social relations intact. Rather, what is needed most is a transformation in

social relations: in community, culture, and economy, in how we relate to each other as human beings, and how we relate to the planet. What is needed, in other words, is an ecological revolution.

## Notes

### *Preface*

1. Epicurus, *The Epicurus Reader* (Indianapolis: Hackett Publishing, 1994), 37.
2. Herman Daly, *Steady-State Economics* (Washington, D.C.: Island Press, 1991), 6, 149-51. Daly presented the Impossibility Theorem in terms of the impossibility of extending the U.S. mode of consumption to a planet with 4 billion people. Now there are 7 billion people and we are considerably overshooting the resources of the planet. Hence the impossibility of extending the U.S. mode of production and consumption to the population of the world as a whole as we approach a world with 9 billion-plus people is all the more obvious.
3. John Kenneth Galbraith, *The Economics of Innocent Fraud* (Boston: Houghton Mifflin, 2004).
4. Fred Magdoff and John Bellamy Foster, "What Every Environmentalist Needs to Know about Capitalism," *Monthly Review* 61/10 (March 2010): "1-30.
5. For more extensive treatments of the environmental problem, see John Bellamy Foster, Brett Clark, and Richard York, *The Ecological Rift* (New York: Monthly Review Press, 2010); Fred Magdoff and Brian Tokar, *eds., Agriculture and Food in Crisis* (New York: Monthly Review Press, 2010); Fred Magdoff, "Ecological Civilization," *Monthly Review* 62/8 (January 2011): 1-25.

### Chapter 1. The Planetary Ecological Crisis

1. Frederick Engels, "The Part Played by Labour in the Transition from Ape to Man," in Karl Marx and Frederick Engels, *Collected Works* (New York: International Publishers) 25:460-61.
2. Plato, *Timaeus and Critias* (London: Penguin, 1977), 133-34.
3. Johan Rockstrorn et al., "A Safe Operating Space for Humanity, "*Nature* 461 (September 24, 2009): 472-75; and "Planetary Boundaries," *Ecology and Society* 14/2 (2009), http://ecologyandsociety.org. On the relation between planetary boundaries and the concept of ecological rift see John Bellamy Foster, Brett Clark, and Richard York, *The Ecological Rift* (New York: Monthly Review Press, 2010), 13-19.
4. James Hansen, Reto Ruedy, Makiko Sato, and Ken Lo, "Global Temperature and Europe's Frigid Air," December 11, 2010, Columbia.edu/~jehl; "Global Surface Temperature Change," *Reviews of Geophysics* 48 (2010): 23; U.S. Department of Commerce National Climate Data Center, *State of the Climate Global Analysis Annual 2010,* accessed January 25, 2011, http://www.ncclc.noaa.gov/ sotc/global/2010/13.
5. James Hansen, *Storms of My Grandchildren* (New York: Bloomsbury, 2009), 164.
6. Arctic Sea Ice News & Analysis, National Snow and Ice Data Center, September 15, 2010 report, http://nsidc.org/arcticseaicenews/.
7. "Seas Could Rise Up to 1.6 meters by 2100: Study," *Reuters,* May 3, 2011.
8. Hansen, *Storms of My Grandchildren,* 82-85; Richard S. J. Tol et al., "Adaptation to Five Meters of Sea Level Rise," *Journal of Risk Research 5* (July 2006): 469.
9. Agence France Presse (AFP),"Peru Glacier Collapses, Injures 50," April 12, 2010.
10. World Glacier Monitoring Service/United Nations Environment Programme, *Global Glacier Change: Facts and Figures* (2008), http://grid.unep.ch/glaciers; Baiqing Xu et al., "Black Soot and the Survival of Tibetan Glaciers," *Proceedings of the National Academy of Sciences,* December 8, 2009, http://pnas.org; Carolyn Kormann, "Retreat of Andean Glaciers Foretells Water Woes," *Environment* 360, http://e360.yale.edu/; David Biello, "Climate Change Is Ridding the World's Tropical Mountain Ranges of Ice," *Scientific American Observations,* December 15, 2009, http://scientificamerican.com; Union of Concerned Scientists, "Contrarians Attack 1PCC Over Glacial Findings, but Glaciers Are Still Melting," January 19, 2010, http://ucsusa.org.

11. Daniel Boyce, Marion Lewis, and Boris Worm, "Global Phytoplankton Decline over the Past Century," *Nature* 466/7306 (July 29, 2010): 591-96; Gautam Naik, "Study Says Planet Warmed in 2000s," *Wall Street Journal, July* 29, 2010.
12. AFP, "UN Warns of 70 Percent Desertification by 2025," October 4, 2005; "Flooding Australia," *The Economist,* January 12, 2011, http://economist.com.
13. Omar Waraic, "Record Rains—But Pakistan Is Dying for Water," *The Independent* (UK), August 1, 2010.
14. Jesse A. Logan and James A. Powell, "Ghost Forests, Global Warming, and the Mountain Pine Beetle (Coleoptera: Scolytidae)," *American Entomologist* 47/3 (2001): 160-72; "80% of Whitebark Pines in Inner West Dead or Dying," *Climate Signals,* August 4, 2010, http://climatesignals.org/.
15. Shaobing Peng et al., "Rice Yields Decline with Higher Night Temperature from Global Warming," *Proceedings of the National Academy of Sciences* 101/ 27 (2005): 9971-75.
16. David B. Lobell, Marianne Banziger, Cosmos Magorokosho, and Bindiganavile Vivek, "Nonlinear Heat Effects on African Maize as Evidenced by Historical Yield Trials," *Nature Climate Change,* published online March 13,2011, www.nature.com/nclimate/journal/vaop/ ncurrent/full/nclimate 1043.html, accessed on March 25,2011.
17. David B. Lobell, Wolfram Schlenker, and Justin Costa-Roberts, "Climate Trends and Global Crop Production since 1980," *Science,* published Online, May 5, 2011.
18. James Hansen, "Strategies to Address Global Warming" (July 13, 2009), www.columbia.edu/~jehl/mailings/2009/200907l3_Stralegies.pdf; Hansen, *Storms of My Grandchildren,* 145-47.
19. Hansen, *Storms of My Grandchildren,* 83; Orrin H. Pilkey and Rob Young, *The Rising Sea* (Washington: Island Press, 2009).
20. Rockstrom et al., "A Safe Operating Space for Humanity," 473; "Ocean Acidification: 'Evil Twin' Threatens World's Oceans, Scientists Warn," *Science Daily,* April 1, 2010, http://science daily.com.
21. Rockstrom et al., "A Safe Operating Space for Humanity," 473 , and "Planetary Boundaries"; "Dobson Unit," http://theozonehole.com.
22. Richard Leakey and Roger Lewin, *The Sixth Extinction* (New York: Random House, 1995); Niles Eldredge, "The Sixth Extinction" (June 2001), http://actionbioscience.org/newfrontiera/eldi-edge2.html; Rockstrom et al., "A Safe Operating Space for Humanity," 473-74.
23. Frank Jordans, "17,000 Species Threatened by Extinction," *Associated Press,* November 3, 2009.
24. Monitra Pongsiri et al., "Biodiversity Loss Affects Global Disease Ecology," *Bioscience* 59/11 (2009): 945-54.
25. Rockstrom et al., "A Safe Operating Space for Humanity," 473-74; Foley, "Boundaries for a Healthy Planet."
26. Rockstrom et al., "Planetary Boundaries," 8, 1.5-16.
27. Maude Barlow, *Blue Covenant* (New York: New Press, 2007), 3.
28. Sudip Mazurndar, "Arid Land, Thirsty Crops," *Scientific American* vol. 304:26 (April 2011).
29. United Nations Food and Agricultural Organization, www.fao.org.
30. Rockstrom et al., "Planetary Boundaries," 8-9. 16-17.
31. Ibid., 9, 17-18.
32. Ibid., 9, 18-19.
33. Lindsey Hoshaw, "Afloat in the Ocean, Expanding Islands of Trash," *New York Times,* November 10, 2009.
34. Jennifer Ackerman, "Plastic Surf: The Unhealthful Afterlife of Toys and Packaging," *Scientific American* 303/2: 88-89 (August 2010).
35. U.S. Department of Agriculture, Agricultural Marketing Service, *Pesticide Data Program, Annual Summary, Calendar Year 2008* (December 2009). www.ams.usda.gov/AMSvl.O/getfilePdDocName =STELPRDC5081750.
36. Bobbi Chase Wilding, Kathy Curtis, Kirsten Welker-Hood, *Hazardous Chemicals in Health Care: A Snapshot of Chemicals in Doctors and Nurses,* Physicians for Social Responsibility, www.psr.org.
37. "Flame Wars; Chemical Pollution and Fertility," *The Economist,* January 30, 2010.
38. Philip J. Landrigan, "What Causes Autism? Exploring the Environmental Contribution," *Current Opinion in Pediatrics* 22/2 (2010): 219-225.

39. Maryse F. Bouchard, David C. Bellinger, Robert O. Wright, and Marc G. Weisskopf, "Attention-Deficit/Hyperactivity Disorder and Urinary Metabolites of Organophosphate Pesticides," *Pediatrics,* May 17, 2010, http://www.pediatncs.org.

40. Lyndsey Layton, "Use of Potentially Harmful Chemicals Kept Secret under Law," *Washington Post,* January 4, 2010.

41. Editors, "Chemical Control," *Scientific American,* April 2010, http://www.scientificamencan.com/article.cm)?id=chemical-controls.

42. David A. Fahrenthold, "Environmental Protection Agency Will List Bisphenol 'Chemical of Concern,'" *Washington Post,* March 30, 2010.

43. David Leonhardt, "Weak Rules on Toxins and Safety," *New York Times,* March 30, 2010.

44. LaSalle D. Leffall Jr. and Margaret L. Kripke, *Reducing Environmental, Cancer Risk: What We Can Do Now,* U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute, April 2010.

45. Rachel Carson, *Lost Woods* (Boston: Beacon Press, 1998), 210.

**Chapter 5. Can Capitalism Go Green?**

1. Bill McKibben, *Earth* (New York: Henry Holt, 2010). 49.

2. Benjamin Barber, "A Revolution in Spirit," *The Nation,* February 9, 2009, http://www.thenation.com/doc/20090209/Barber.

3. Paul Hawken, Amory Lovins, and E. Hunter Lovins, *Natural Capitalism* (Boston: Little, Brown, 1999). For a detailed critique of the ideology of "natural capitalism," see F. E. Trainer. "Natural Capitalism Cannot Overcome Resource Limits." *Minnesotans for Sustainability* (2001) http://www.mnforsustain.org.

4. Hawken, Lovins, and Lovins, *Natural Capitalism:* Al Gore, *Our Choice* (New York: Rodale, 2009), 346.

5. Worldwatch Institute, *State of the World 2010* (New York: W.W. Norton, 2010), 83-84; Herman E. Daly, "Economics in a Full World," *Scientific American* 293/3 (September 2005): 100-107.

6. James Gustave "Gus" Speth, "Towards a New Economy and a New Politics," *Solutions* 5 (May 28, 2010).

7. David Harvey, "Nice Day for a Revolution," *Independent* (UK), April 29, 2011.

8. On market inefficiencies and failures see Charles E. Lindblom, *The Market System* (New Haven: Yale University Press. 2001), 147-75. On the refusal of mainstream economics to confront the reality of market failure see John Cassidy, *How Markets Fail* (New York: Farrar, Straus and Giroux, 2009).

9. For a systematic discussion of how the market reduces the transparency of social relations see Bertell Ollman, "Market Mystification in Capitalism and Market Socialist Societies," in Oilman, ed., *Market Socialism: The Debate among Socialists* (New York: Routledge, 1998), 81-121.

10. This critique is systematically developed in Karl Polanyi's classic *The Great ^transformation* (Boston: Beacon Press, 1944).

11. James K. Galbraith, *The Predator State* (New York: Free Press, 2008), 19.

12. Joseph Schumpeter, *Capitalism, Socialism, and Democracy* (New York: Harper and Brothers, 1942); C. B. Macpherson, *The Life and Times of Liberal Democracy* (New York: Oxford University Press, 1977).

13. See especially Thomas Ferguson, *Golden Rule: The Investment Theory of Party Competition and the Logic of Money-Driven Political Systems* (Chicago: University of Chicago Press, 1995).

14. Rachel Carson, *Lost Woods* (Boston: Beacon Press, 1998), 210: and *Silent Spring* (Boston: Houghton Mifflin, 1994), 13.

15. Derrick Jensen and Aric McBay, *What We Leave Behind* (New York: Seven Stories, 2009), 201-6.

16. UN Secretary-General Ban Ki-moon, November 8, 2007, http://www.uii.org/News/Press/docs/2007/sgsmll268.doc.htm.

17. Jensen and McBay, *What We Leave Behind,* 201-6.

18. Fredric Jameson, "The Future of the City," *New Left Review* 21 (May-June 2003): 76.

19. "Gucci Joins Other Fashion Players in Committing to Protect Rainforests," *The Independent,* November 5, 2009.

20. Daniel McGinn, "The Greenest Big Companies in America," *Newsweek,* September 21, 2009, www.newsweek.com.

21. Patric Wintour, "Green Consumerism Can Avert Climate Disaster, Say Top Firms," *The Guardian,* October 16, 2009.

22. Joel Bakan, *The Corporation* (New York: Free Press, 2004), 39-46.

23. Ibid., 109.

24. Tomas Mac Sheoin, "Chemical Catastrophe: From Bhopal to BP Texas *City," Monthly Review* 62/4 (September 2010): 21-33.

25. "Panel: BP and Others Made Risky Decisions before Spill," January 5, 2011, http:msnbc.msn.com.

26. Friedman quoted in Bakan, *The Corporation,* 41-42.

27. Martin Hickman, "Why Eco-Friendly Products Are Not as Green as They Appear," *The Independent* (UK), April 29, 2010.

28. Heather Rogers, *Green Gone Wrong* (New York: Scribner, 2010), 182.

29. Rachel Beck, "BP Gimmicks Fail to Hide Truth," Associated Press, July 11, 2010.

30. Beck, "BP Gimmicks Fail to Hide Truth."

31. Eleanor Laise, "Oops: 'Socially Responsible' Funds Hold Big Stakes of BP," *Wall Street Journal,* July 17,2010.

32. The analysis in this paragraph draws on John Bellamy Foster, Brett Clark, and Richard York, *The Ecological Rift* (New York: Monthly Review Press, 2010), 388-90. See also Ray Anderson, Mona Amodeo, and Ida Kubiszewski, "Changing Business Cultures from Within," Worldwatch Institute, *State of the World, 2010,* 99-101; Michael Maniates, "Editing Out Unsustainable Behavior," in Worldwatch, *State of the World, 2010,* 125-26; Stacy Mitchell, "Keep Your Eyes on the Size: The Impossibility of a Green Wal-Mart," *Grist,* March 28, 2007, http://www.grist.org; Sarah Anderson, "Wal-Mart's New Greenwashing Report," November 20, 2007, http://www.alternet.org; Wes Jackson, quoted m Rogers, *Green Gone Wrong,* 191.

33. Katherine Harmon, "How Does Geothermal Drilling Trigger Earthquakes?," *Scientific American, June* 29,2009, http://www.scien-tificamerican.com/article.cfm?id=geothermal-drilling-earthquakes.

34. Lisa Margonelli, "Clean Energy's Dirty Little Secret," *Atlantic Magazine,* May 2009.

35. Fred Magdoff, "The Political Economy and Ecology of Biofuels," *Monthly Review* 60/3 (July-August 2008), 34-50.

36. David A. Fahrenthold, "Chemicals that Eased One Woe Worsen Another," *Washington Post,* July 20, 2009.

37. Foster, Clark, and York, *The Ecological Rift,* 169-82.

38. Hannah Arendt, *The Human Condition* (Chicago: University of Chicago Press, 1958), 253.

39. See Ulrich Beck, *Risk Society* (Newbury Park, CA: Sage Publications, 1992): and his *World Risk Society* (Maiden, MA: Polity Press, 1999).

40. For a powerful critique of risk management by a leading environmental scientist, see Mary O'Brien, *Making Better Environmental Decisions: An Alternative to Risk Assessment* (Cambridge, MA: MIT Press, 2000); also Charles Perrow, *Normal Accidents: Living with High-Risk Technologies* (New York: Basic Books, 1984).

41. Perrow, *Normal Accidents;* James Lovelock, *The Revenge of Gaim* (New York: Perseus, 2006), 87-105; James Hansen, *Storms of My Grandchildren* (New York: Bloomsbury USA, 2009), 198-204. On the continuing dangers of nuclear power, even in its latest incarnations, see Robert D. Furber, James C. Warf, and Sheldon C. Plotkin, "The Future of Nuclear Power," *Monthly Review* 59/9 (February 2008): 38-48; and Mark Z. Jacobson and Mark A. Delucchi, "Providing All Global Energy with Wind, Water, and Solar Power, Part I," *Energy Policy* 39 (2011): 1154-1169, www.stanford.edu/group/efmh/jacobson/Articles/I/JDEn PolicyPtl.pd.

42. Klaus S. Lackner. "Washing Carbon out of the Air," *Scientific American* 302/6 (June 2010): 66-71.

43. American Physical Society, "Direct Air Capture of CO2 with Chemicals," May 9, 2011, http://aps.org.

44. Hansen, *Storms of My Grandchildren,* 173-74,193-94; and Hansen, "Coal-Fired Plants Are Death Factories," *The Observer,* February 15, 2009; Paul Epstein, et. al, "Full Cost Accounting for the Life Cycle of Coal," *Annals of the New York Academy of Sciences* 1219 (2011): 73-98; Kentuckians for the Commonwealth, "The Reality of the 'Clean Coal' Campaign," January 30,2009, http://www.kftc.org.

45. John Broder, "From Theory to a Consensus on Emissions," *New York Times,* May 17, 2009. Emphasis added.

46. Friends of the Earth, "Subprime Carbon?," March 2009, http://www.foe.org/suprime carbon; and *A Dangerous Obsession,* November 2009, http://www.foe.co.uk; James Hansen, "Worshipping the Temple of Doom," May 5, 2009, http://wvm.columbia.edu/~jehl/mamngs/2009/20090505JTemple OfDoom.pdf; Larry Lohman, "Climate Crisis: Social Science Crisis," *The Corner House,* July 9, 2008, http://thecornerhouse.org.uk/resource/climate-crisis-social-science-crisis.

47. Rogers, *Green Gone Wrong,* 149-77; David Connett and Chris Stevenson, "Green schemes are 'wide open to major corruption'," *The Independent* (UK), May 1, 2011.

48. James Kanter, "Cap-and-Trade Is Beginning to Raise Some Concerns," *New York Times,* August 30, 2010.

49. Kanter, "Cap-and-Trade."

50. Hansen, "Worshipping the Temple of Doom."

51. See Paul Burkett, "Marx's Vision of Sustainable Human Development," *Monthly Review* 57:5 (October 2005): 34-62.

52. David Owen, "The Inventor's Dilemma," *The New Yorker,* May 17, 2010.

53. Owen, "The Inventor's Dilemma."