Capitalism and the Accumulation of Catastrophe

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Over the next few decades we are facing the possibility, indeed the probability, of global catastrophe on a level unprecedented in human history. The message of science is clear. As James Hansen, the foremost climate scientist in the United States, has warned, this may be "our last chance to save humanity."[1] In order to understand the full nature of this threat and how it needs to be addressed, it is essential to get a historical perspective on how we got where we are, and how this is related to the current socioeconomic system, namely capitalism.

Fundamental to the ecological critique of capitalism, I believe, is what world-historian William McNeill called the law of "the conservation of catastrophe." For McNeill, who applied his "law" to environmental crisis in particular, "catastrophe is the underside of the human condition—a price we pay for being able to alter natural balances and to transform the face of the earth through collective effort and the use of tools." The better we become at altering and supposedly controlling nature, he wrote, the more vulnerable human society becomes to catastrophes that "recur perpetually on an ever-increasing scale as our skills and knowledge grow."[2] The potential for catastrophe is thus not only conserved, but it can be said to be cumulative, and reappears in an evermore colossal form in response to our growing transformation of the world around us.

In the age of climate change and other global planetary threats McNeill's thesis on the conservation of catastrophe deserves close consideration. Rather than treating it as a universal aspect of the human condition, however, this dynamic needs to be understood in historically specific terms, focusing on the tendency toward the conservation of catastrophe under historical capitalism. The issue then becomes one of understanding how the exploitation of nature under the regime of capital has led over time to the accumulation of catastrophe. As Marx explained, it is necessary, in any critique of capitalism, to understand not only the enormous productive force generated by capital, but also "the negative, i.e. destructive side" of its interaction with the environment, "from the point of view of natural science."[3]

The Revenge of Nature

In analyzing the causes of the conservation of catastrophe, McNeill explained: "Human purposes are extraordinarily fragile because they never take full account of the circumstances on which they impinge, and every so often act as triggers, provoking results that were not imagined by those who precipitated them. It follows…that the more skillful human beings become at making over natural balances to suit themselves, the greater the potential for catastrophe."[4]

If we were to look for an historical antecedent for this argument, we could not do better than to turn to Frederick Engels's *Dialectics of Nature*, written in the 1870s. In Engels's words: "Every day that passes we are acquiring a better understanding of these

[nature's] laws and getting to perceive both the immediate and the more remote consequences of our interference with the traditional course of nature." As a result of the development of science, we are "more than ever in a position to realize, and hence to control…the more remote natural consequences of at least our day-to-day production activities." Consequently, human beings increasingly "not only feel but also know their oneness with nature."

Nevertheless, the contradiction enters in when we recognize that "the present mode of production is predominantly concerned only about the immediate, the most tangible result," and proceeds on that basis only. "Surprise is expressed that the more remote effects of actions directed to this end [of economic development and wealth accumulation] turn out to be quite different, are mostly quite the opposite in character." We discover too late that in the pursuit of our self-interested and shortsighted ends we are undermining the very conditions of production. "What cared the Spanish planters in Cuba," Engels asked, when "they burned down forests on the slopes of the mountains and obtained from the ashes sufficient fertilizer for *one* generation of very highly profitable coffee trees—what cared they that the heavy tropical rainfall afterwards washed away the unprotected upper stratum of the soil, leaving behind only bare rock!" In heedlessly removing forests for the sake of production and profits people unwittingly remove everything forests provide:

> The people, who in Mesopotamia, Greece, Asia Minor and elsewhere, destroyed the forests to obtain cultivable land, never dreamed that by removing along with the forests the collecting centers and reservoirs of moisture that they were laying the basis for the present forlorn state of those countries. When the Italians of the Alps used up the pine forests on the southern slopes, so carefully cherished on the northern slopes, they had no inkling that by doing so they were cutting at the roots of the dairy industry of their region; they had still less inkling that they were thereby depriving their mountain springs of water for the greater part of the year and making it possible for them to pour still more furious torrents on the plains during the rainy seasons.

All our growing science in this area, Engels added, was negated if we could not address the reality of capitalist production and its dire effects on the environment—thereby inviting the "revenge" of nature.[5]

The late eighteenth and nineteenth centuries saw the development of an acute awareness among natural scientists of the destruction of the natural environment, extending to concerns over local and regional climate change. The power of the human social system to transform the earth in destructive ways was recognized as never before. This was evident in the work of such leading scientific figures as Horace Bénédict de Saussure (1740–99), Alexander von Humboldt (1769–1859), Matthias Schleiden (1804–81), Charles Lyell (1797-1875), George Perkins Marsh (1801–82), Charles Darwin (1809–82), and Carl Nikolaus Fraas (1810–75). Growing apprehensions regarding the disastrous consequences of the human transformation of the environment arose initially out of a recognition of the negative, long-term effects of recent European expansion into previously unknown or relatively inaccessible regions, particularly the tropics and island environments, and to some extent the Alpine regions of Europe. Moreover, the increasing awareness of the human capacity to degrade whole regions encouraged

scientists to investigate the role of human agency in the desertification of parts of the Middle East, North Africa, and Mediterranean Europe.6

The Swiss geologist De Saussure concluded in 1779, as a result of his studies of Alpine lakes, that water levels had decreased in modern times due to the cutting of forests.7 Likewise the German geographer Alexander von Humboldt determined in his explorations that the water level in a lake in Venezuela, which he visited in 1800, had diminished due to deforestation. In a much-quoted passage, he wrote: "By felling the trees which cover the tops and sides of mountains, men in every climate prepare at once two calamities for future generations; want of fuel and scarcity of water."8

The German botanist Schleiden, one of the pioneers in cell theory, wrote extensively on the human destruction of the natural environment. Schleiden was particularly concerned with climate change in historical times, and saw humanity as a factor in triggering such changes. In carrying out "his" actions, "man," he argued in *The Plant: A Biography* (1848), brings about "results which surprise even himself, because he does not at the moment mark the gradually accumulating consequences of his labours…nor led by necessary knowledge foresee the final results." There were strong indications in the historical records, Schleiden insisted, "that those countries which are now treeless and arid deserts, part of Egypt, Syria, Persia, and so forth, were formerly thickly wooded, traversed by streams," but were now "dried up or shrunk within narrow bounds" and exposed to the full force of the sun. He attributed these changes to the environment in historical time primarily to the disappearance of forests by human hand. "Behind him," Schleiden concluded, "he [man] leaves the Desert, a deformed and ruined land" and is guilty of the "thoughtless squandering of vegetable treasures…. Here again in selfish pursuit of profit, and, consciously or unconsciously, following the abominable principle of the great moral Vileness which one man has expressed, '*après nous le déluge*,' he [man] begins anew the work of destruction."9

About the same time as Schleiden's discussion of climate change, the German agronomist Fraas published his influential work, *Climate and the Plantworld* (1847), which focused on the human destruction of the forests of Mesopotamia, Persia, Palestine, Egypt, and southern Europe. Arguing against seeing such environmental change as due purely to natural causes, he emphasized the importance of human beings in generating more arid climates in these regions. "The developing culture of people," Fraas wrote, "leaves a veritable desert behind it."10

Both Lyell and Darwin in England were concerned with the enormous destruction that humanity had in recent times wrought on the environment, and with questions of climate change. Lyell noted in his *Principles of Geology* in 1832: "The felling of forests has been attended, in many countries, by a diminution of rain, as in Barbados and Jamaica." Looking at these processes dialectically, he argued: "There can be no doubt that the state of the climate, especially the humidity of the atmosphere, influences vegetation, and that, in its turn, vegetation reacts upon the climate." Lyell called this "the reciprocal action of vegetation and climate." Humanity increasingly interfered with this reciprocal action by clearing forests. Even more important than deforestation in altering the overall environment, for Lyell, was "the drainage of lakes and marshes," since this greatly modified "the general climate of a district."11

Darwin provided his most impassioned testimony on the human destruction of the environment in relation to his visit to the isolated island of St. Helena during the famous voyage of the Beagle. In his 1839 *Journal of Researches into the Geology and Natural History of the Various Countries Visited During the Voyage of the HMS Beagle* he commented extensively on the devastating deforestation wrought since the introduction of goats to the island at the beginning of European settlement in 1502. "So late as the year 1716," he wrote,

> there were many trees [in the area previously called the Great Wood], but in 1724 the old trees had mostly fallen; and as goats and hogs had been suffered to range about, all the young trees had been killed…. The extent of surface probably covered by wood at a former period, is estimated at no less than two thousand acres; at the present day scarcely a single tree can be found there. It is also said that in 1709 there were quantities of dead trees in Sandy Bay; this place is now so utterly desert that nothing but so well attested an account [the records left by Alexander Beatson] could have made me believe that they could ever have grown there.12

The growing anxiety of scientists over human destruction of the natural environment, including local and regional climate change, had a considerable effect on Marx and Engels. Not only did they pay constant attention to developments in natural science—they were close students of the work of Schleiden, Fraas, Lyell, and Darwin, and were familiar with the contributions of De Saussure and Humboldt—but they added to this their own historical-materialist critique of capitalist- ecological destruction. Marx admired Fraas, both as an agronomist and for his analysis of climate change. He regarded Fraas's *Climate and the Plantworld*, in particular, as "proving that climate and flora change in *historical* times," i.e. in the period of human history. Summing up Fraas's views, Marx wrote: "With cultivation—depending on its degree—the 'moisture' so beloved by the peasants gets lost (hence also the plants migrate from south to north)…. The first effect of cultivation is useful, but finally devastating through deforestation, etc…. The conclusion is that cultivation—when it proceeds in natural growth and is not *consciously controlled* (as a bourgeois he [Fraas] naturally does not reach this point)—leaves deserts behind it. Persia, Mesopotamia, etc., Greece. So once again an unconscious socialist tendency!"13 Likewise Engels took careful notes from Fraas's book, writing that it constituted "the main proof that civilization is an antagonistic process that, in its form up to the present, has exhausted the land, devastated the forests, rendered the land unfertile for its original crops and made the climate worse. Prairies and the increased heat and dryness of the climate are the consequences of culture [civilization]."14 In *Capital* Marx echoed Schleiden's earlier argument, contending that capital accumulation is heedless in the destruction of its own human and natural bases, operating on the principle of "*Après moi le déluge!*"15

At all times the critique of environmental destruction developed by Marx and Engels pointed to the conservation of catastrophe under capitalism. Engels wrote in *The Dialectics of Nature* that human beings, through conscious action in accord with rational science, are capable of rising to a considerable extent above "the influence of unforeseen effects and uncontrolled forces." Yet, even with respect to "the most developed peoples of the present day" there is "a colossal disproportion between the proposed aims and the results arrived at," such "that unforeseen effects predominate and…the uncontrolled forces are more powerful than those set into motion according to

plan." The reason for this was that as long as production, in class-dominated society, was itself "subject to the interplay of unintended effects from uncontrolled forces" and achieved "its desired end only by way of exception," more often producing "the exact opposite," a rational approach to nature was impossible.16

Marx's most direct contribution to the critique of ecological destruction of course was his theory of metabolic rift, which I have examined extensively elsewhere. This was derived from what Marx called "Liebig's soil exhaustion theory," whereby industrialized agriculture by removing the nutrients (such as nitrogen, phosphorus, and potassium) from the soil and shipping them to the cities, sometimes hundreds and thousands of miles, undermined the recirculation of these nutrients back to the soil. Marx employed the concept of metabolism to explain the necessary relation of human beings to the earth through production, and argued that a rift or break had developed in the metabolic cycle. Hence, this "eternal natural condition for the lasting fertility of the soil" demanded its "systematic restoration."

Nevertheless, the metabolic rift was "irreparable" for capitalist society. Driven by its accumulation motive, capital was unable to limit its destructiveness or to follow the precepts of natural science. Indeed, "the more a country proceeds from large-scale industry as the background of its development," Marx argued, "the more rapid is the process of destruction." The problems created by this rift in the human-natural metabolism would therefore accumulate, even if they were shifted around—creating a growing imperative of ecological restoration. Indeed, it was here that Marx stressed that it was "one of Liebig's immortal merits" to have developed "from the point of view of natural science *the negative, i.e. destructive side of modern agriculture*" (emphasis added).17

Similar views on the rising scale of ecological degradation in capitalist society were to be expressed by E. Ray Lankester, a friend of Darwin, Huxley, Marx, and William Morris, and the leading Darwinian biologist in England in the generation after Darwin himself. Lankester read and benefitted from Marx's *Capital* and was one of the two members of the British Royal Society at Marx's funeral. He was a strong materialist and exhibited socialist sympathies, albeit of the more Fabian variety. He was also the most powerful critic of ecological destruction in his time, known for his essays on the extinction of species and human degradation of the environment.18 In his article, "The Effacement of Nature by Man," written before the First World War, Lankester pointed to the unconscious destruction of the earth. "Very few people," he wrote,

> have any idea of the extent to which man…has actively modified the face of Nature, the vast herds of animals he has destroyed, the forests he has burnt up, the deserts he has produced, and the rivers he has polluted. It is [in]…the cutting down and burning forests of large trees that man has done the most harm to himself and the other living occupants of many regions of the earth's surface…. Forests have an immense effect on climate, causing humidity of both the air and the soil, and give rise to moderate and persistent instead of torrential streams…. Areas of destruction of vegetation [were] often (though not always), both in Central Asia and North Africa (Egypt, etc.), started by the deliberate destruction of forest by man.

"It is not 'science,'" Lankester insisted, "that will be to blame for these horrors": the destruction of the earth and the natural environment of living species, undermining the conditions of "future generations." Rather, should civilization-threatening disasters "come about they will be due to the reckless greed and mere insect-like increase of humanity." Although depicting uncontrolled population growth as a factor in ecological degradation, Lankester had no doubt about the main force at work, declaring elsewhere that capitalist businesses were "necessarily by their nature, devoid of conscience," and were impersonal mechanisms "driven by laws of supply and demand."[19]

Lankester was the mentor of Arthur Tansely, another materialist scientist and Fabian-style socialist, who founded the British Ecological Association. Tansley is most famous for introducing the concept of ecosystem—in conflict with the idealist, indeed outright racist, strand of ecology, associated with General Smuts in South Africa. The socialist wing of the ecological movement—including leading Marxist scientists such as Lancelot Hogben and Hyman Levy, but also figures like Tansley and H.G. Wells—were strongly opposed to the idealist-racist ecology promoted by Smuts and his adherents. But it was Tansley who introduced the most effective critique.

In his famous 1935 article on "The Use and Abuse of Vegetational Concepts and Terms," Tansley developed the ecosystem concept as the basis for a materialist ecology, relying heavily on the dialectical-systems analysis provided in Levy's *The Universe of Science*. Central to Tansley's argument was the recognition of "the destructive human activities of the modern world." Humanity, he argued, was "an exceptionally powerful biotic factor which increasingly upsets the equilibrium of previous ecosystems and eventually destroys them." Human beings were thus capable of what he called "catastrophic destruction" in relation to the environment. This meant that scientific-materialist ecology needed to be introduced as a rational counter to such irrational tendencies imbedded in contemporary society.[20]

At about the same time that Tansley introduced the ecosystem concept, another protégé of Lankester, the esteemed British biologist, J.B.S. Haldane, one of the originators of the neo-Darwinian synthesis and a Marxist, wrote an essay entitled "Back to Nature," critically taking up this slogan already present in his time. Haldane argued that humanity might have to give up some of the wasteful "artificialities" of commodity society in order to maintain a sustainable relation to the earth. Yet, the real need in this respect, he insisted, was to create an entirely different socioeconomic system, beyond capitalism; in which case the more essential aspects of civilization, representing genuine human needs, could be preserved.[21]

Hence, even prior to the Second World War, ecologists, particularly those who combined their concern for nature with socialist views, were clear that a radical change in the relation between production and the environment was needed—one requiring foresight and planning.

The Heterogeneity of Ends and the Need for Rational Ecological Planning

The argument that I have advanced up to this point suggests that ecological science can be thought of as arising out of the growing conflict between the developing capitalist system and the planetary environment. The birth of scientific ecology represented the slowly emerging recognition of what Marx called the "negative, i.e.

destructive side" of industrialization "from the point of view of natural science." Some of the most perceptive scientists, especially those with a socialist bent, recognized already in the nineteenth century (and in the opening decades of the twentieth century) that humanity had become a natural force, unconsciously unleashing unprecedented ecological destruction on the earth. Going against the dominant celebration of capitalist industrialization as an unalloyed triumph over nature, some of the most acute observers in the scientific community were aware, a century or more ago, that catastrophe in the human relation to nature had not been overcome, but rather had been in a sense conserved, even accumulating in potential with the development of human productive powers. Just as the short-term power of humanity over nature increased along with the scale of the economy, so did the long-run potential for ecological (and economic) catastrophe.

For dialectical thinkers like Marx and Engels the social-ecological problem was seen through the prism of a materialist-dialectical philosophy of revolutionary social change. This can be understood in terms of what is known as the "heterogeneity (or heterogony) of ends"—a concept introduced by the German psychologist and philosopher Wilhelm Wundt in his *Ethics* (1886). Wundt argued that individual and collective goals shift over time as a result of the unforeseen effects on the natural and social environment. The pursuit of immediate aims often produces unintended negative consequences, leading to radically new conditions and actions—a "mutation of motives." For Wundt the contradiction associated with the heterogeneity of ends was most tragically apparent in societies "where egoism rules supreme." The question there was: "What do the living care for future generations? '*Après nous le déluge*,' they will say, until the flood sweeps them away with the words on their lips."22 Yet, the heterogeneity of ends also stood for the capacity of human beings to respond in radically new ways to changing conditions.

Ironically, given the nature of Wundt's critique, the heterogeneity of ends is often associated in today's scholarship with "invisible hand explanations" of social organization such as those of Adam Smith, whereby the pursuit of individual greed is seen as leading paradoxically to the greater good for society as a whole. Conservative twentieth-century thinkers like Michael Polanyi and Friedrich Hayek expanded this into a theory of "spontaneous order," fundamental to contemporary neoliberalism. In this view, the unintended consequences of selfish and acquisitive behavior, if left to themselves, inevitably produce social equilibrium, in an analogue to divine providence. This has generated a kind of secular religion dominating the approach to economy and environment in capitalist society, which supposedly obviates the need for a social role for science, rational planning, or democratic agency.23

Yet, the more dialectical view of the heterogeneity of ends associated with thinkers such as Hegel, Marx, and Wundt, is far removed from this one-sided notion of spontaneous order. It suggests instead that the unintended consequences of our actions can be negative as well as positive, producing disequilibrium as well as equilibrium, destruction as well as construction—and giving rise to a radical transmutation of motives in response to crises/catastrophes. Wundt clearly drew his inspiration in part from Hegel's complex notion of the "cunning of reason," which emphasized that the "passions of individuals" governing historical action frequently lead to tragedy, loss, and destruction—out of which human reason, for Hegel, ultimately triumphs (by means of the modern bourgeois state).24

Hence, when Marx argued (from a socialist-materialist rather than liberal-idealist standpoint) that there was a tendency for cultivation to leave deserts behind it, and that this necessitated rational, scientific planning—constituting what he called "an unconscious socialist tendency"—he was presenting a dialectical notion of the heterogeneity of ends with respect to human-natural interactions. In this view, the advent of ecological crisis/catastrophe necessitates *conscious, collective action* aimed at the "systematic restoration" of the human metabolism with nature.

What was being called for, in the emerging ecological thought of the nineteenth and early twentieth century, was the rational regulation of the human-nature relation. However, "this regulation" of the social-ecological metabolism, Engels observed, "requires something more than knowledge. It requires a complete revolution in our hitherto existing mode of production, and simultaneously a revolution in our whole contemporary social order."25

"So active has civilization been" in the "destruction" of natural conditions, Marx critically observed in relation to forests, that "everything that has been done for their conservation and protection is insignificant in comparison."26 The contradictory result of such meager attempts to protect natural conditions under the prevailing social order is often simply to strengthen the main tendency to destruction. Thus the capitalist system has long sought to overcome problems of (1) deforestation, by very limited reforestation; (2) drought and desertification, simply through irrigation and drawing down groundwater sources; (3) species extinction, by protecting a few keystone species; and (4) depletion of soil nutrients, through the production of synthetic fertilizers. This constitutes an overall ameliorative approach to conservation, which, due to the very limited and contradictory nature of the "solutions," is in many ways self-defeating, reinforcing the accumulation of catastrophe. Thus, the overuse of nitrogen and phosphorus fertilizers, introduced in response to systematic soil depletion, has contributed massively today—a century and a half after the soil depletion problem was diagnosed by Liebig—to the eutrophication of surface water bodies (a condition in which nutrient-rich waters induce the growth of algae resulting in the depletion of dissolved oxygen, threatening fish and other aquatic animals). This has become a major factor in the generation of dead zones in coastal waters. The failure to arrest rampant deforestation, desertification, and species extinction, evident over the centuries, is now worsening global climate change, as each of these destructive impacts on the local and regional environments interact with global warming.

All of this points to the unavoidable reality that in a regime in which capital accumulation is the beginning-and-end-all, a sustainable relation to the environment is impossible. "Disaster capitalism," as Naomi Klein has called it, is a reflection, not simply of neoliberalism, but of the underlying tendencies of the system itself.27 So universally disastrous has capitalism become today that our only hope is that a radical mutation of motives may arise as a result of these changed conditions—giving birth to a historic movement to reverse the course of destruction.

Planetary Capitalism and Revolt

In the twenty-first century it is customary to view the rise of planetary ecological problems as a *surprising development* scarcely conceivable prior to the last few decades. It is here, however, that we have the most to learn from the analysis of

nineteenth-century thinkers who played a role in the development of ecology, including both early ecological scientists and classical historical materialists. Science has long warned of the negative, destructive side of the human transformation of the earth—a warning which the system, driven by its own imperatives, has continually sought to downplay.

Indeed, what distinguishes our time from earlier centuries is not so much the *conservation of catastrophe*, which has long been recognized, but rather the accelerated pace at which such destruction is now manifesting itself, i.e., what I am calling the *accumulation of catastrophe*. The desertification arising in pre-capitalist times, partly through human action, manifested itself over centuries, even millennia. Today changes in the land, the atmosphere, the oceans, indeed the entire life-support system of the earth, are the product of mere decades. If in the past, Darwin was struck that in a mere three centuries after European colonization, the ecology of the island of St. Helena had been destroyed to the point that it was reduced to "desert"—today, in only two generations, we have altered the biogeochemical processes of the entire planet.[28]

The absence of a historical perspective on the conservation, even accumulation, of catastrophe is a major barrier to needed change in our time. Many environmentalists, including some who perceive themselves as being on the left, persist in believing that we can address our immense and growing ecological problems without altering our fundamental social-production relationships. All that is necessary in this view is the combined magic of green technology and green markets. Short-term fixes are presumed to be adequate solutions, while society remains on the same essential course as before.

Indeed, the dominant perspective on ecology can be characterized, I believe, as consisting of three successive stages of denial: (1) the denial altogether of the planetary ecological crisis (or its human cause); (2) the denial that the ecological crisis is fundamentally due to the system of production in which we live, namely capitalism; and (3) the denial that capitalism is constitutionally incapable of overcoming this global ecological threat—with capital now being presented instead as the savior of the environment.

The first stage of ecological denial is easy to understand. This is the form of denial represented by Exxon-Mobil. Such outright denial of the destructive consequences of their actions is the automatic response of corporations generally when faced with the prospect of environmental regulations, which would negatively affect their bottom lines. It is also the form of absolute denial promoted by climate-change denialists themselves, who categorically reject the reality of human agency in global climate change.

The second stage of denial, a retreat from the first, is to admit there is a problem,while dissociating it from the larger socioeconomic system. The famous IPAT formula, i.e. Environmental Impact = Population x Consumption x Technology (which amounts to saying that these are the three factors behind our environmental problems/solutions), has been used by some to suggest that population growth, the consumption habits of most individuals, and inappropriate technology carry the totality of blame for environmental degradation. The answer then is sustainable population, sustainable consumption, and sustainable technology. This approach, though seemingly matter-of-fact, and deceptively radical, derives its acceptability for the vested interests

from the fact that it generally serves to disguise the more fundamental reality of the treadmill of capitalist production itself.29

The third stage of denial, a last-ditch defense, and exhibiting a greater level of desperation on the part of the established order, is, I would argue, the most dangerous of all. It admits that the environmental crisis is wrapped up with the existence of capitalism, but argues that what we need is an entirely new kind of capitalism: variously called "sustainable capitalism," "green capitalism," "natural capitalism," and "climate capitalism" by thinkers as various as Al Gore, Paul Hawken, Amory and L. Hunter Lovins, and Jonathon Porritt.30 The argument here varies but usually begins with the old trope that capitalism is the most efficient economic system possible—a form of "spontaneous order" arising from an invisible hand—and that the answer to ecological problems is to make it more efficient still by internalizing costs on the environment previously externalized by the system.

Aside from the presumed magic of the market itself, and moral claims as to "the greening of corporations," this is supposed to be achieved by means of a black box of technological wonders. Implicit in all such views is the notion that capitalism can be made sustainable, without altering its accumulation or economic growth imperative and without breaking with the dominant social relations. The exponential growth of the system *ad infinitum* is possible, we are told, while simultaneously generating a sustainable relation to the planet. This of course runs up against what Herman Daly has called the Impossibility Theorem: If the whole world were to have an ecological footprint the size of the United States we would need multiple planets.31 The idea that such a development process can persist permanently on a single planet (and indeed that we are not at this point already confronting earthly limits) is of course an exercise in delusion, bordering on belief in the supernatural.

"Capitalism," as the great environmental economist K. William Kapp once wrote, is "an economy of unpaid costs."32 It can persist and even prosper only insofar as it is able to externalize its costs on the mass of the population and the surrounding environment. Whenever the destruction is too severe the system simply seeks to engineer another spatial fix. Yet, a planetary capitalism is from this standpoint a contradiction in terms: it means that there is nowhere finally to externalize the social and environmental costs of capitalist destruction (we cannot ship our toxic waste into outer space!), and no external resources to draw upon in the face of the enormous squandering of resources inherent to the system (we can't solve our problems by mining the moon!).

Market-based solutions to climate change, such as emissions trading, have been shown to promote profits, and to facilitate economic growth and financial wealth, while *increasing* carbon emissions. From an environmental standpoint, therefore, they are worse than nothing—since they stand in the way of effective action. Nor are the technologies most acceptable to the system (since not requiring changes in property relations) the answer. So-called "clean coal" or carbon capture and storage technologies are economically unfeasible and ecologically dubious, and serve mainly as an ideological justification for keeping coal-fired plants going.

Worse still, are geoengineering schemes like dumping sulfur particles in the atmosphere or iron filings in the ocean (the first in order to deflect the sun's rays, the

second in order to promote algal growth to increase ocean absorption of carbon). These schemes carry with them the potential for even greater ecological disasters: in the first case, this could lead to a reduction of photosynthesis, in the second the expansion of dead zones. Remember the Sorcerer's Apprentice![33]

The potential for the accumulation of catastrophe on a truly planetary level as a result of geoengineering technology is so great that it would be absolute folly to proceed in this way—simply in order to avoid changes in the mode of production, i.e., a fundamental transformation of our way of life, property relations, and metabolism with nature.

Science tells us that we are crossing planetary boundaries everywhere we look, from climate change, to ocean acidification, to species destruction, to freshwater shortages, to chemical pollution of air, water, soil, and humans. The latest warning sign is the advent of what is called "extreme weather"—a direct outgrowth of climate change. As Hansen says: "Global warming increases the intensity of droughts and heat waves, and thus the area of forest fires. However, because a warmer atmosphere holds more water vapor, global warming must also increase the intensity of the other extreme of the hydrologic cycle—meaning heavier rains, more extreme floods, and more intense storms driven by latent heat." Scientists involved in the new area of climate-attribution science, where extreme weather events are examined for their climate signatures, are now arguing that we are rapidly approaching a situation where the proverbial "'hundred-year' flood" no longer occurs simply once a century, but every few years. Natural catastrophes are thus likely to become more severe and more frequent occurrences in the lives of all living beings. The hope of some scientists is that this will finally wake up humanity to its true danger.[34]

How are we to understand the challenge of the enormous accumulation of catastrophe, and the no less massive human action required to address this? In the 1930s John Maynard Keynes wrote an essay entitled "Economic Possibilities of Our Grandchildren," aimed at defending capitalism in response to revolutionary social challenges then arising. Keynes argued that we should rely for at least a couple more generations on the convenient lie of the Smithian invisible hand—accepting greed as the basis of a spontaneous economic order. We should therefore continue the pretense that "fair is foul and foul is fair" for the sake of the greater accumulation of wealth in society that such an approach would bring. Eventually, in the time of our "grandchildren"—maybe a "hundred years" hence (i.e., by the early 2030s)—Keynes assumed, the added wealth created by these means would be great enough that we could begin to tell the truth: that foul is foul and fair is fair. It would then be necessary for humanity to address the enormous inequalities and injustices produced by the system, engaging in a full-scale redistribution of wealth, and a radical transformation of the ends of production.[35]

Yet, the continued pursuit of Keynes's convenient lie over the last eight decades has led to a world far more polarized and beset with contradictions than he could have foreseen. It is a world prey to the enormous unintended consequences of accumulation without limits: namely, global economic stagnation, financial crisis, and planetary ecological destruction. Keynes, though aware of some of the negative economic aspects of capitalist production, had no real understanding of the ecological perils—of which scientists had already long been warning. Today these perils are impossible to overlook.

Faced with impending ecological catastrophe, it is more necessary than ever to abandon Keynes's convenient lie and espouse the truth: that foul is foul and fair is fair. Capitalism, the society of "*après moi le déluge*!" is a system that *fouls* its own nest—both the human-social conditions and the wider natural environment on which it depends. The accumulation of capital is at the same time accumulation of catastrophe, not only for a majority of the world's people, but living species generally. Hence, nothing is *fairer*—more just, more beautiful, and more necessary—today than the struggle to overthrow the regime of capital and to create a system of substantive equality and sustainable human development; a socialism for the twenty-first century.

"Well grubbed, old mole!"[36]

Notes

1. ↩ James Hansen, *Storms of My Grandchildren* (New York: Bloomsbury, 2009).
2. ↩ William H. McNeill, *The Global Condition* (Princeton: Princeton University Press, 1992), 135–49, and "The Conservation of Catastrophe," *New York Review of Books*, December 20, 2001, 86–88.
3. ↩ Karl Marx, *Capital*, vol. 1 (London: Penguin, 1976), 638.
4. ↩ McNeill, *The Global Condition*, xiv.
5. ↩ Karl Marx and Frederick Engels, *Collected Works*, vol. 25 (New York: International Publishers, 1975), 460–64.
6. ↩ It should be noted that some nineteenth-century concerns regarding local and regional climate change proved to be exaggerated in some respects and prescient in others. Although downplayed by a majority of scientists for the most of the twentieth century, the ability of human beings to alter climate on a regional basis is no longer in serious doubt today. Thus the United Nations Convention to Combat Desertification has highlighted human-made desertification. For treatments of this problem see Daniel Hillel, *Out of the Earth* (Berkeley: University of California Press, 1991), 175–89; Brian Fagan, *Floods, Famines, and Emperors* (New York: Basic Books, 1999), 217–18. On the science of climate change in Germany in the late nineteenth century see Eduard Brüchner, *The Sources and Consequences of Climate Change and Climate Variability in Historical Times* (Boston: Kluwer Academic Publishers, 2000).
7. ↩ Clarence J. Glacken, "Changing Ideas of the Habitable World," in William L. Thomas Jr., *Man's Role in Changing the Face of the Earth*, vol. 1 (Chicago: University of Chicago Press, 1956), 77–78. De Saussure was the first to develop the hypothesis of a greenhouse effect in the regulation of the atmosphere—a thesis taken up by Joseph Fourier, and then verified experimentally by John Tyndall in 1859, who demonstrated that carbon dioxide and other gases "checks its [solar heat's] exit" back into space. Karl Marx, who was attending some of Tyndall's lectures at the Royal Institution at the time, and who was particularly interested in the latter's experiments on solar radiation, was quite likely in the audience on one of the occasions when these results were presented in 1859 and 1861. See Michael Hulme, "On the Origin of 'The Greenhouse Effect': John Tyndall's 1859 Interrogation of Nature," *Weather* 64, no. 5 (May 2009): 121–23; Daniel Yergin, *The Quest* (New York: Penguin, 2011), 425–28; Friedrich Lessner, "Before 1848 and After," in Institute for Marxism-Leninism, ed., *Reminiscences of Marx and Engels* (Moscow: Foreign Languages Publishing House, n. d.), 161; Y.M. Uranovsky, "Marxism and Natural Science," in Nikolai

Bukharin, et. al., *Marxism and Modern Thought* (New York: Harcourt, Brace and Co., 1935), 140.

8. ↩ Glacken, "Changing Ideas," 78–79; Alexander von Humboldt, *Personal Narrative of Travels to the Equinoctial Regions of America, During the Years 1799–1804* (London: Henry G. Bohn, 1852), 9–10; J.B. Boussingault, *Rural Economy in its Relations with Chemistry, Physics and Meteorology* (New York: D. Appleton, 1845), 501–7.
9. ↩ M.J. Schleiden, *The Plant: A Biography* (London: H. Baillere, 1853), 295, 303–7.
10. ↩ Fraas quoted by Frederick Engels, in Karl Marx and Friedrich Engels, *Gesamtausgabe* (*MEGA*), IV, 31 (Amsterdam: Akadamie Verlag, 1999), 512–15. Translation into English by Joseph Fracchia. Drawing on Fraas, Marsh in the United States argued in his *Man and Nature* (1864): "Clearing and cultivation have affected climate," while "change in climate" in turn "has essentially modified the character of vegetable life." The significance of this was not to be doubted. "With the disappearance of the forest," Marsh wrote, "all is changed." George Perkins Marsh, *Man and Nature* (Seattle: University of Washington, 2003), 14, 186–87.
11. ↩ Charles Lyell, *Principles of Geology*, vol. 2 (London: John Murray, 1832), 200–205.
12. ↩ Charles Darwin, *Journal of Researches into the Geology of the Various Countries Visited During the Voyage of the H.M.S Beagle* (New York: E.P. Dutton, 1906), 470–71; Charles Darwin, *Beagle Diary* (New York: Cambridge University Press, 1988), 428–29; Richard Grove, *Green Imperialism* (Cambridge: Cambridge University Press, 1995), 42–44, 95–109, 121–25, 343–45.
13. ↩ Karl Marx and Frederick Engels, *Collected Works*, vol. 42 (New York: International Publishers, 1975), 558–59.
14. ↩ Marx and Engels, *MEGA*, IV, 31 (Amsterdam: Akadamie Verlag, 1999), 512–15. Translation by Joseph Fracchia.
15. ↩ Marx, *Capital*, vol. 1, 381.
16. ↩ Marx and Engels, *Collected Works*, vol. 25, 330–31.
17. ↩ Marx and Engels, *Collected Works*, vol. 42, 507; Marx, *Capital*, vol. 1, 636–39; Karl Marx, *Capital*, vol. 3 (London: Penguin, 1981), 948–50.
18. ↩ See John Bellamy Foster, "E. Ray Lankester: Ecological Materialist," *Organization and Environment* 13, no. 2 (June 2000): 233–35.
19. ↩ E. Ray Lankester, *Science From an Easy Chair* (Freeport, New York: Books for Libraries Press, 1913), 365–72. Like Engels, Lankester followed Darwin in pointing to St. Helena as an example of ecological destruction. Ibid., 369; Marx and Engels, *Collected Works*, vol. 25, 459.
20. ↩ Arthur G. Tansley, "The Use and Abuse of Vegetational Concepts and Terms," *Ecology* 16, no. 3 (1935): 284–307. See also John Bellamy Foster, Brett Clark, and Richard York, *The Ecological Rift* (New York: Monthly Review Press, 2010), 324–32.
21. ↩ J.B.S. Haldane, "Back to Nature," April 18, 1938, Haldane Papers, University of London, Box 7.
22. ↩ Wilhelm Wundt, *Ethics*, vol. 3 (New York: Macmillan, 1907), 66, 84–88, 101–3; Kurt Danziger, "The Unknown Wundt," in Robert W. Rieber and David K. Robinson, *Wilhelm Wundt in History* (New York: Plenum, 2001), 108–9; A.A. Goldenweiser, "William Wundt," *The Freeman* (July 6, 1921): 397–98.

23. ↩ See Michael Polanyi, *The Logic of Liberty* (Chicago: University of Chicago Press, 1951), 154–65; F.A. Hayek, *Law, Legislation and Society* (Chicago: University of Chicago Press, 1973), 35–59; Duncan Forbes, "Scientific Whiggism," *Cambridge Journal* 7 (August 1954): 643–70; Louis Schneider, *Paradox and Society* (New Brunswick: New Jersey: Transaction Books, 1987), 169–73.
24. ↩ G.W.F. Hegel, *The Philosophy of History* (New York: Dover, 1956), 33. Wundt, however, complained that Hegel's approach in this respect was as one-sided (and teleological) as the individualism of the Smithian variety. Wundt, *Ethics*, vol. 3, 34–35.
25. ↩ Marx and Engels, *Collected Works*, vol. 25, 462.
26. ↩ Karl Marx, *Capital*, vol. 2 (London: Penguin, 1978), 322.
27. ↩ Naomi Klein, *The Shock Doctrine*: *The Rise of Disaster Capitalism* (New York: Henry Holt, 2007).
28. ↩ On the general issue of the "acceleration of history" in relation to the environmental problem see John Bellamy Foster, *The Vulnerable Planet* (New York: Monthly Press, 1999), 143–49. At issue here is not only the acceleration of the potential for environmental catastrophe, but also the needed accelerated response: ecological revolution itself.
29. ↩ Deeper analyses of the IPAT approach, reflecting a genuine radical critique of the system, have shown that the treadmill of capitalist economic growth is the primary problem. See Richard York, Eugene A. Rosa, and Thomas Dietz, "Footprints on the Earth," *American Sociological Review* 68, no. 2 (2003): 279–300; Allan Schnaiberg, *The Environment* (New York: Oxford, 1980).
30. ↩ Al Gore, *Our Choice* (New York: Rodale, 2009), 346; Paul Hawken, Amory Lovins, and L. Hunter Lovins, *Natural Capitalism* (Boston: Little Brown, 1999); L. Hunter Lovins and Boyd Cohen, *Climate Capitalism* (New York: Hill and Wang, 2011); Jonathon Porritt, *Capitalism: As If the World Mattered* (London: Earthscan, 2007).
31. ↩ Herman Daly, *Steady-State Economics* (Washington, D.C.: Island Press, 1991), 6, 149–51. Also Fred Magdoff and John Bellamy Foster, *What Every Environmentalist Needs to Know About Capitalism* (New York: Monthly Review Press, 2011), 7–8.
32. ↩ K. William Kapp, *The Social Costs of Private Enterprise* (New York: Schocken Books 1971), 231.
33. ↩ As Marx and Engels noted, capitalist society had "conjured up such gigantic means of production and exchange…[that] like the sorcerer, who is no longer able to control the powers of the nether world whom he has called up by his spells" it is faced with one crisis after another. Karl Marx and Frederick Engels, *The Communist Manifesto* (New York: Monthly Review Press, 1964), 11.
34. ↩ Hansen, *Storms of My Grandchildren*, xv–xvi, 252–55; John Carey, "Storm Warnings: Extreme Weather is a Product of Climate Change," ScientificAmerican.com, June 28, 2011; Heidi Cullen, *The Weather of the Future* (New York: Harper, 2010).
35. ↩ John Maynard Keynes, *Essays in Persuasion* (New York: Harcourt, Brace and Co., 1932), 358–73.
36. ↩ Karl Marx, *The Eighteenth Brumaire of Louis Bonaparte* (New York: International Publishers, 1991), 121. For Marx, the mole digging so industrially away beneath the earth represented the unseen, changing historical conditions, which would give rise to a period of radical social change.