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Marx's Ecology and the Left

JOHN BELLAMY FOSTER AND BRETT CLARK

One of the lasting contributions of the Frankfurt School of social theorists, represented especially by Max Horkheimer and Theodor Adorno's 1944 *Dialectic of Enlightenment*, was the development of a philosophical critique of the domination of nature. Critical theorists associated with the Institute for Social Research at Frankfurt were deeply influenced by the early writings of Karl Marx. Yet their critique of the Enlightenment exploitation of nature was eventually extended to a critique of Marx himself as an Enlightenment figure, especially in relation to his mature work in *Capital*. This position was expressed most notably in the work of Horkheimer and Adorno's student, Alfred Schmidt, author of *The Concept of Nature in Marx*. Due largely to Schmidt's book, the notion of Marx's anti-ecological perspective became deeply rooted in Western Marxism. Such criticisms were also closely related to questions raised regarding Frederick Engels's *Dialectics of Nature*, which was said to have improperly extended dialectical analysis beyond the human-social realm. First-stage ecosocialists such as Ted Benton and André Gorz added to these charges, contending that Marx and Engels had gone overboard in their alleged rejection of Malthusian natural limits.

So all-encompassing was the critique of the "dialectic of the Enlightenment" within the main line of the Frankfurt School, and within what came to be known as "Western Marxism" (defined largely by its rejection of the dialectics of nature associated with Engels and Soviet Marxism), that it led to the estrangement of thinkers in this tradition not only from the later Marx, but also from natural science—and hence nature itself.¹ Consequently, when the ecological movement emerged in the 1960s and '70s, Western Marxism, with its abstract, philosophical notion of the domination of nature, was ill-equipped to analyze the changing and increasingly perilous forms of material interaction between humanity

JOHN BELLAMY FOSTER is the editor of *Monthly Review* and a professor of sociology at the University of Oregon. His most recent book, coauthored with Paul Burkett, is *Marx and the Earth: An Anti-Critique* (Brill, 2016). **BRETT CLARK** is an associate professor of sociology at the University of Utah and the author, with Stefano B. Longo and Rebecca Clausen, of *The Tragedy of the Commodity* (Rutgers University Press, 2015).

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and nature. Making matters worse, some Marxian theorists—such as Neil Smith and Noel Castree—responded by inverting the Frankfurt School critique of the domination of nature with the more affirmative notion of “the production of nature,” which conceived nature and its processes as entirely subsumed within social production.²

Matters changed, however, with the rise in the late 1990s of a second-stage ecosocialism that returned to Marx’s materialist-ecological approach, and particularly to his concept of “social metabolism,” while also reincorporating elements of Engels’s ecological thought. This development represented a sharp break with the earlier Frankfurt School-influenced approach to the question of Marx and nature. Surveying this history, we will examine the debates on Marxian ecology that have emerged within the left, while pointing to the possibility of a wider synthesis, rooted in Marx’s concepts of the “universal metabolism of nature,” the “social metabolism,” and the metabolic “rift.”

Criticisms of Marx’s Concept of Nature

Paul Burkett described Schmidt’s *The Concept of Nature in Marx* in 1997 as “perhaps the most influential study ever written on Marx’s view of nature.”³ The book appeared in Germany in 1962, the same year as Rachel Carson’s *Silent Spring*, often seen as the starting point of the modern environmental movement. *The Concept of Nature in Marx* began as Schmidt’s dissertation in philosophy, written between 1957 and 1960 under the supervision of Horkheimer and Adorno, and was “impregnated with the influence of ‘critical theory.’”⁴ It thus antedated the modern environmental movement both historically and philosophically. Yet Schmidt’s work, carrying the imprimatur of the Frankfurt School, would come to shape the attitudes of many New Left theorists towards Marx in the context of the burgeoning environmental movement of the 1960s–1980s. As Marxian geographer Neil Smith put it in 1984, Schmidt’s book was considered the “definitive study” of nature in Marx.⁵

The Concept of Nature in Marx was deeply affected by the broader Weberian pessimism of the Frankfurt School, which viewed the “domination of nature” as an intrinsic characteristic of modernity or “the dialectic of the Enlightenment.”⁶ Under Enlightenment civilization, Horkheimer and Adorno declared, “either men will tear each other to pieces or they will take all the flora and fauna of the earth with them; and if the earth is then still young enough, the whole thing will have to be started again at a much lower stage.”⁷ Although Schmidt brought a number of important, positive contributions to the understanding of nature in Marx, it was his more pessimistic conclusions about the mature Marx, in the spirit

of Horkheimer and Adorno, that proved most influential. Rejecting the outlooks of “utopian” Marxist theorists such as Bertolt Brecht and Ernst Bloch who, based on the early Marx, sought a “reconciliation” between humanity and nature through socialism, Schmidt concluded,

The mature Marx withdrew from the [utopian] theses expounded in his early writings. In later life he no longer wrote of a “resurrection” of the whole of nature. The new society is to benefit man alone, and there is no doubt that this is to be at the expense of external nature. Nature is to be mastered with gigantic technological aids, and the smallest possible expenditure of time and labor. It is to serve all men as the material substratum for all conceivable consumption goods.

When Marx and Engels complain about the unholy plundering of nature, they are not concerned with nature itself but with considerations of economic utility.... The exploitation of nature will not cease in the future, but man’s encroachments into nature will be rationalized, so that their remoter consequences will remain capable of control. In this way, nature will be robbed step by step of the possibility of revenging itself on men for their victories over it.⁸

The last phrase was a reference to Engels, whose views on the need for human beings to control their social relation to nature under socialism in order to prevent ecological crises (which he referred to metaphorically as the “revenge” of nature) Schmidt interpreted as a case for the extreme “rationalization” and external control of nature.⁹ There was no real room in Engels, any more than in Marx, Schmidt insisted, for anything but a one-sided, conqueror’s approach to nature—despite Engels’s criticisms of precisely this perspective. Engels was reinterpreted as representing a crude, one-sided domination of nature outlook, with the implication that such views could be foisted on Marx himself. In the end, classical historical materialism was reduced to a reified, mechanistic worldview, which advocated a narrow instrumentalism, geared to unrestrained productivism, as the only possible forward course for humanity. The mature Marx, in the Frankfurt School interpretation, thus led inexorably to the same Weberian iron cage with respect to the instrumentalist rationalization of nature as did both capitalism and Soviet Marxism.¹⁰

Close readers of Schmidt’s work were no doubt puzzled by the contradictions in his reading of Marx. For Schmidt could not have arrived at these conclusions, in an otherwise sophisticated philosophical reading of Marx’s theory of nature, without turning the early Marx against the later Marx, Marx against Engels, Marx against Brecht and Bloch, and even, as we shall see, the mature Marx against the mature Marx.¹¹ Brilliant as Schmidt’s analysis was, it was colored by a double polemic: first, against those who sought to apply the broad anthropological, humanistic, and

ecologically utopian perspectives of the early Marx to the later Marx; and second, against all those, associated with a more classical historical materialism, who suggested that a more sustainable path of development could be achieved under socialism.¹²

Schmidt's study was further compromised by a threefold failure to comprehend the depths of Marx's critique. First, Schmidt's deterministic notion of technology and industrialization under capitalism, and the automatic carrying over of this into socialism, obscured the full significance of Marx's historically specific critique of the capitalist value form, in which value, emanating from labor alone, was in contradiction to wealth, deriving from both nature and labor.¹³ For Marx, the goal was not a society aimed at endless quantitative expansion (exchange value) but at the fulfillment of qualitative needs (use value). Second, Schmidt saw Marx's emphasis on the metabolism of nature and society as a broad philosophical "metaphor," a form of speculative metaphysics. It was not treated as a scientific category, related to actual material exchanges and systemic (thermodynamic) processes—though he recognized that element in Marx.¹⁴ Third, Schmidt attributed to Marx a conception of external nature as consisting of unchanging, invariant laws—that is, a passive, dualistic, and rigidly positivist conception of nature, in which even evolutionary development within nature (outside humanity) conformed to narrowly delineated, fixed processes. Nature, outside of human nature and human society, was in this vision both passive and mechanical.

Although Schmidt briefly discussed a more dialectical concept of nature in Marx, ultimately Marx was interpreted as adhering in his mature phase to a mechanistic-positivistic scientific view.¹⁵ "The attitude of the mature Marx," Schmidt wrote, "has in it nothing of the exuberance and unlimited optimism to be found in the idea of the future society prescribed in the Paris Manuscripts. It should rather be called skeptical. Men cannot in the last resort be emancipated from the necessities imposed by nature."¹⁶ Hence, Marx was transformed into a forerunner of the skepticism, world-weariness, and dualistic division between natural science and social science, and between non-human nature and society, that characterized Schmidt's own mentors, Horkheimer and Adorno. Indeed, Adorno went so far as to declare that Marx "underwrote something as arch-bourgeois as the program of an absolute control of nature."¹⁷

Adhering to a neo-Kantian epistemological outlook with respect to nature and society, Horkheimer and Adorno, along with Schmidt, rejected both the Hegelian idealist philosophy of nature and the Marxian materialist dialectics of nature (associated especially with Engels),

while simultaneously rejecting the early Marx's "unlimited optimism" toward the reconciliation of naturalism and humanism. The dialectic, in the Frankfurt School view, was applicable only to the reflexive realm of society and human history. Natural science, insofar as it was directed at the external, objective world apart from human beings, was depicted as inherently positivistic and separate from the human sciences. Hence, the early Frankfurt School thinkers were themselves for the most part caught in the contradictions of what they called the "dialectic of Enlightenment," falling prey to a larger epistemological dualism between nature and society from which there was no exit. This did not prevent them from simultaneously developing a negative philosophical critique of the Enlightenment domination of nature; but it was one that had no meaningful relation to praxis. Here their views were closest to Max Weber's well-known critical pessimism with respect to the Enlightenment.¹⁸ As in Weber's tragic vision, the "iron cage" of formal rationality offered no visible escape, pointing inexorably to the disenchantment and domination of nature, against which one could only offer empty protests.

For Horkheimer, the "decay of civilization" in modern times arises from the fact that "men cannot utilize their power over nature for the rational organization of the earth"—a problem that he attributed to the formal rationalization common to both capitalism and socialism, and endemic to the modern human relation to the environment.¹⁹ The decay of civilization was associated with the reactionary rise of new repressive tendencies such as fascism, in which "raw nature," in "revolt against reason," represented animality, primitiveness, and crude Darwinism. "Whenever man deliberately makes nature his principle," Horkheimer wrote, "he regresses to primitive usages.... Animals...do not reason.... In summary, we are the heirs, for better or worse, of the Enlightenment and technological progress."²⁰ A vain attempt to escape this trap could only lead to a world of barbarism. It followed that Marx's notion of liberation was inevitably forced to accede to the Enlightenment vision of implacable technological progress as the determining force in history. In this sense, Horkheimer was quite distant from his Frankfurt School colleague Herbert Marcuse, who saw more room for struggle against the repressive use of technology and for the development of a non-alienated human-ecological metabolism.²¹

Schmidt recognized the abstract possibility of a more revolutionary-critical interpretation of Marx's view of nature.²² Yet he dismissed this reading, not so much in terms of Marx's own analysis, but rather those of mid-twentieth century critical theory, represented by Horkheimer

and Adorno. “We should ask,” he wrote, “whether the future society [socialism] will not be a mammoth machine, whether the prophesy of *Dialektik der Aufklärung* [*Dialectic of Enlightenment*] that ‘human society will be a massive racket in nature’ will not be fulfilled rather than the young Marx’s dream of a humanization of nature, which would at the same time include the naturalization of man.”²³ The utopian young Marx, in his view, was refuted by the realist mature Marx, who succumbed to the technocratic rationality of the Enlightenment. As a result, Marxism offered no way out of the “massive racket in nature.”

Schmidt’s account of Marx’s concept of nature, with all of its inconsistencies and convolutions, positing one contradiction after another in Marx’s own analysis, reduced historical materialism in the end to a repressive Enlightenment vision—one that reinforced and served to justify Frankfurt School skepticism, pessimism, and worldly alienation. Such views were in many ways a product of the divisions within Marxism that began in the 1930s and deepened after 1956.²⁴ Western Marxism, as a distinct, largely philosophical, tradition, tended to see classical Marxism—particularly Engels but also extending to Marx himself—as falling prey to positivism.

Commenting on this tendency, William Leiss, a former student of Marcuse, observed in *The Domination of Nature* that “Alfred Schmidt’s excellent book...attempts (unsuccessfully) to present Marxism as an extreme form of Saint-Simonianism”—i.e., reflecting an inherently techno-industrial relation to the conquest of nature.²⁵ Likewise, for Neil Smith, Schmidt depicted the socialist relation to nature as conceived by Marx as “pretty much like capitalism except worse: the domination of nature.”²⁶ In Burkett’s more critical judgment, Schmidt’s analysis of *The Concept of Nature in Marx* ended up “in a quagmire of environmental despair.”²⁷

Despite these limitations, Schmidt, in what can be considered the most original and profound part of his work, centered his argument on Marx’s now famous concept of social and ecological “metabolism.” Here, he wrote, “Marx introduced a completely new understanding of man’s relation to nature.”²⁸ The metabolism category, as employed by Marx in relation to the labor process, made it possible to “speak meaningfully of a ‘dialectic of nature.’” The notion of social metabolism thus pointed to what Marx himself had called the possibility of a “higher synthesis” in the human-nature relation.²⁹

Nevertheless, Marx’s metabolism argument was ultimately marginalized in the later parts of Schmidt’s analysis.³⁰ Schmidt suggested that Marx’s notion of metabolism as a dialectical mediation between nature

and society through labor and production involved recourse to a form of metaphysical speculation—one that constituted a negative, non-historical ontology.³¹ He erroneously attributed Marx's use of the metabolism concept primarily to the influence of the crudely mechanistic scientific materialist Jacob Moleschott—rather than Roland Daniels and Justus von Liebig, the two thinkers Marx drew on most directly. Schmidt saw it as both *pre-bourgeois*, in the backward-looking sense of a utopian, almost mystical attempt to resurrect a past unity, and *mechanistic*, leading him to dismiss what he previously described as a meaningful dialectic of nature.³²

Ultimately failing to comprehend the full complexity and range of possibility opened up by Marx's concept of social metabolism—an approach that was at once philosophical, political-economic, and physiological—Schmidt rejected it as a metaphysical, metaphorical, and mechanical category, reflecting a “peculiarly unhistorical dialectic of the process of metabolism,” a “rigid cyclical form of nature” that was “anterior to man.”³³ Recognizing that Marx had introduced a materialist dialectic that connected nature and society, human production/reproduction and the natural-material conditions of existence, Schmidt nonetheless pulled back, wishing to avoid the question of a dialectic of nature. He thus limited the dialectic to an abstracted social realm.

This general outlook on Marx's concept of nature was carried forward and reinforced in various ways in the first-stage ecosocialism that arose in 1970s and '80s. Early ecosocialist thinkers, following Schmidt, criticized Marx and Marxism for allegedly downplaying natural limits to economic growth, and thus ecological constraints. They therefore eclectically promoted “the greening of Marxism” by grafting onto Marx's analysis neo-Malthusian notions of environmental constraints, together with purely ethical views of the nature-humanity interrelationship associated with deep ecology and “ecologism.”³⁴ Although they constituted an important self-critique on the part of left theorists, these arguments generally avoided any close scrutiny of the foundations of historical materialism, particularly where issues of natural science were involved.

“The revival of Marxism in the 1960s and 1970s” took for granted, in the critical assessment of historian Eric Hobsbawm, “the nonapplicability of Marx's thought (as distinct from that of Engels, which was regarded as separable and different) to the field of the natural sciences.”³⁵ The new Marxism of this period, as distinct from earlier periods of historical materialism, “left the natural sciences totally to one side.” Marx's comprehensive analysis of the natural conditions underlying production and the capitalist economy was generally elided in studies

of his work, or dismissed as uninteresting and inessential—even in early ecosocialist accounts.

The Western left concluded that an ecological outlook occupied at best only a marginal place in Marx's historical materialism, and was largely discarded in his later economic works.³⁶ Expressing what was then the general view within Western Marxism, Perry Anderson wrote in 1983 that "problems of the interaction of the human species with its terrestrial environment [were] essentially absent from classical Marxism."³⁷ This claim, however, nullified not only Engels's voluminous discussions of the relation of human beings to their natural-physical environment, but also the extensive discussions of natural-material relations and natural science—and within these, ecological concerns—by Marx himself.³⁸

For an important first-stage ecosocialist like Benton, Marx had gone overboard in his critique of Malthus, to the point of exhibiting a "reluctance to recognize 'nature-imposed limits' to human development" altogether. Malthus, meanwhile, was himself to be critically reappropriated in the process of the "greening of Marxism."³⁹ Gorz declared that socialism as a movement was "on its last legs," hobbled by its narrow productivism, inherited from classical Marxism, and by its lack of a "reflexive modernist" view of nature-society relations.⁴⁰ Likewise, Marxian economist James O'Connor, editor of the journal *Capitalism Nature Socialism*, declared that "Marx hinted at, but did not develop, the idea that there may exist a contradiction of capitalism that leads to an 'ecological' theory of crisis and social transformation."⁴¹ Alain Lipietz, writing in *Capitalism Nature Socialism*, went even further, declaring that Marx underestimated "the irreducible character...of ecological constraints" and adopted "the Biblico-Christian ideology of the conquest of nature."⁴²

Such first-stage ecosocialist thinkers commonly attributed the alleged ecological blind spots in Marx's political economy to intrinsic flaws in the labor theory of value. Since "all value was derived from labor power," environmental sociologist Michael Redclift wrote, "it was impossible [for Marx] to conceive of a 'natural' limit to the material productive forces of society."⁴³ Yet what Redclift and others failed to notice was that it was this very one-sidedness of the value form in capitalism that lay at the center of Marx's critique, associated with the contradiction between wealth (derived from natural-material use values) and value or exchange value (which left out nature altogether). For Marx, once it was recognized that nature—constituting, together with labor, one of the two sources of all wealth—was not included in the capitalist value calculus, but was treated as a "free gift...to capital," it was impossible *not* to recognize both the

existence of natural limits and capital's destructive tendency to override them, in its unending drive to accumulation.⁴⁴

First-stage ecosocialists therefore erroneously perceived Marx's critique of capitalism as, at best, neutral with respect to ecological issues, and, at worst, anti-ecological—even if the early Marx had alluded to the possibility of a unity of naturalism and humanism. Yet socialism itself, in the view of these thinkers, remained essential, chiefly for its critique of labor exploitation. Early ecosocialist thinkers thus grafted Green concepts onto historical-materialist analysis, creating a hybrid, Centaur-like construct. In the case of Benton, perhaps the most articulate spokesperson for first-stage ecosocialism, elements of Marx's critique of political economy, such as his political hostility to "Malthusian 'natural limits' arguments"; the priority given to value theory; his neglect of ecological processes; and his alleged "Prometheanism," or extreme productivism, all "obstructed the development of historical materialism as an explanatory theory of ecological crisis." These presumed shortcomings of Marxism required an "interdisciplinary collaboration between a revised historical materialism and ecology."⁴⁵

Yet as commendable as such a program appeared on the surface, without a thoroughgoing exploration and reconstruction of Marx's own analysis of the nature-society dialectic, the hoped-for higher synthesis could only end up as an eclectic mishmash in which the critical power of the historical-materialist tradition would be lost. More important, the criticisms of Marx within first-stage ecosocialist theory were often distorted, not only in their understanding of Marx's own ecological conceptions, but in the adoption of views (e.g., Malthusianism) that were antagonistic to a fully developed Marxian ecology.

The Production of Nature: A New Human Exemptionalism

Other left theorists took an entirely different tack, distant from both the Frankfurt School and first-stage ecosocialism. Geographer Neil Smith embraced the basic structure of Schmidt's interpretation of Marx, but sought to stand it on its head, contending that Schmidt had himself advanced a "quintessentially bourgeois conception of nature out of his reading of Marx." If Schmidt's *Concept of Nature in Marx* had argued that the mature Marx was caught in the technological determinism and extreme productivism that characterized the dialectic of Enlightenment, Smith offered a far more positive reading, depicting Marx's view as one of the "production of nature," or the constant reinvention and transformation of nature through production. As Smith's follower Noel Castree acknowledged, Smith sought to solve the problem with a one-way

causality from production to nature, leading to a “hyper-constructionist” outlook. Nature was reduced to a passive concept. Smith’s production of nature analysis, Castree noted, “looked more at how capitalism produces nature and less at how produced nature affects capitalism.”⁴⁶ For Smith, in Castree’s words, “nature becomes internal to capitalism.”⁴⁷ This kind of anthropomorphic monism subsumed nature almost completely within society, in an effort to solve the problem of “dualism,” which Smith and Castree charged characterized nearly all other views of the environmental problem.⁴⁸

Hence, in Smith’s inverted Frankfurt School perspective on the domination of nature, nature as a whole was envisioned in almost Baconian terms as increasingly produced by human beings for their own ends. It was possible, he argued, to speak of “the real subsumption of nature” in its entirety within human production. The late twentieth century, he proclaimed, marked the infiltration of society into the last “remnant[s] of a recognizably external nature.” Indeed, there was no longer any meaningful nature anywhere apart from human beings: “Nature is nothing if it is not social.” “The production of nature,” in Smith’s words, was “capitalized ‘all the way down.’” From this perspective, the historical production of nature represented “the unity of nature toward which capitalism drives.” In this ever-increasing, capitalist-generated unity, “first nature” (i.e., nature at its most elemental) was “produced from within and as a part of second nature” (i.e., nature as transformed by society). Smith effectively dismissed any recognition of “external nature” as a dynamic, evolutionary force outside and beyond, and often interacting with, humanity itself, as “dualism,” “fetishism of nature,” and “nature washing.” Natural science was itself to be faulted for focusing on “so-called laws of nature” outside society.⁴⁹

“Given Marx’s own treatment of nature,” Smith went so far as to argue, “it may not be unreasonable to see in his vision also a certain version of the conceptual dualism of nature.”⁵⁰ Marx himself was therefore partly to blame for the rise of “left apocalypticism,” which Smith identified with contemporary environmentalism with its dualistic outlook.⁵¹

Castree followed the same line as Smith, emerging as a major proponent of the production of nature approach, though in a slightly more nuanced form. Castree stated that “Marx did not himself provide a systematic account of nature. This task was left to Alfred Schmidt.”⁵² The brilliance of Schmidt’s analysis, for Castree, was reflected in the fact that he detected a “fundamental flaw” in Marx. Although “Marx apparently envisioned a harmonious balance of nature and society” in his “anticipatory-utopian vision,” this pointed to “a subtext of a will to power:

that is, an affection for technology in the service of human well-being which could unintentionally turn into the domination of nature, and ironically (after Adorno and Horkheimer) into the domination of humans themselves.”⁵³ Following Smith, Castree leveled the accusation of “dualism” at almost all Marxist analysts of nature-society relations, from classical Marxism to the present—hardly sparing Marx himself, whose saving grace, in Castree’s view, was that he had inspired Smith’s unifying conception of the “production of nature.”⁵⁴ In this view, the production of nature perspective eliminated the dualism arising from the separateness of nature by subsuming nature in society. Yet most contemporary ecosocialists, Castree suggested, had failed to incorporate this advance of Smith, and had “reintroduced nature’s putative separateness” in their treatments of Marx.⁵⁵

Production of nature analysis, Smith and Castree declared, had gone beyond classical Marxism, in that it rejected altogether the idea of “external nature,” which had infected even Engels’s *Dialectics of Nature*. “As Smith correctly observes,” Castree pronounced, “nature separate from society has no meaning.”⁵⁶ A developed Marxian approach in this realm rejected the notions of “universal” and “external” nature, since such conceptions inevitably led to the crudities of naturalism and dualism. On this basis, Smith and Castree discarded entirely Marx’s vision of a materialist, open dialectic in which human beings and society form a part of nature, and exist within it, in a complex, mediated, co-evolutionary relationship.⁵⁷

The production of nature argument was itself rooted in a binary conception that pitted dualism against monism. In this view, which lacked the concept of dialectical mediation, in order to escape dualism, one was forced to choose between either a “monistic doctrine of universal nature,” or, at the opposite extreme, a monistic doctrine of the production of nature by society (sometimes given an added nuance by reference to “co-production,” and to a double or hyphenated reality).⁵⁸ The production of nature school itself chose the latter: a monist, hyper-social constructivism, such that nature and natural conditions were entirely subordinated to human production. This in essence is the view that environmental sociologists criticize as human exemptionalism—the anthropocentric notion that human beings are largely exempt from natural laws, or can imperialistically transform them as they wish.⁵⁹

The logical result was Smith’s critique of environmental apocalypticism, directed at the environmental movement. Writing in 2015 about the political consequences of Smith’s production of nature analysis, Castree noted that “certain strands of environmental and body-politics

operative outside universities are now [like Smith himself] dispensing with ‘nature’ as an ontological referent.” Here he cited the book *Break Through* by leading ecological modernists Michael Shellenberger and Ted Nordhaus.⁶⁰ “In a generic sense,” Castree declared, “this mirrors Smith’s insistence that we need new terms of radical political discourse.”⁶¹

Ironically, Castree failed to note that Shellenberger and Nordhaus’s analysis represented exactly the opposite: new terms of reactionary political discourse. The Breakthrough Institute, which Shellenberger and Nordhaus head, is the principal ideological think tank in the United States dedicated to the single-minded promotion of capitalist ecological modernization. As self-designated “post-environmentalists,” thinkers associated with the Breakthrough Institute see technological innovation and market mechanisms as the solution to all environmental problems, and as entirely compatible with unlimited economic growth and capital accumulation. They are thus sharp critics of radical ecology and of environmentalism in general.⁶²

Marx, Metabolism, and the Metabolic Rift

To escape such one-sided views—whether idealist or mechanistic, monist or dualist—which have dominated much left analysis of the nature-society relation since Schmidt, it is necessary to turn to Marx’s ecology itself, in which the materialist conception of history and the materialist conception of nature formed a dialectical unity. By excavating the ecological foundations of classical historical materialism, second-stage ecosocialist theorists since the late 1990s have moved well beyond earlier misconceptions, creating the basis for a wider ecological synthesis. Here the analysis has pivoted on the dialectical approach implicit in Marx’s triadic scheme of “the universal metabolism of nature,” the “social metabolism,” and the metabolic rift.⁶³

Although, as in Marx’s analysis, it still makes sense abstractly to differentiate nature and natural processes from the labor and production process, there is no longer any pure nature untouched by human society; nor is there any pure realm of society free from the dire natural-material consequences of human actions. In the Anthropocene epoch, it is therefore all the more necessary to explore the complex, dialectical natural-social interconnections between the Earth system as a whole and capitalism as a system of alienated social metabolic reproduction *within* that Earth system. Today the drive to capital accumulation is disrupting the planetary metabolism at cumulatively higher levels, threatening irreversible, catastrophic impacts for countless species, including our own. It is in the theorization of this ecological and social dialectic, and in the

development of a meaningful praxis to address it, that Marx's analysis has proven indispensable.

Second-stage ecosocialism sought to return to Marx and earthly questions. The aim was to draw on the ecological foundations of classical historical materialism to develop a more unified socio-ecological critique. British Marxist sociologist Peter Dickens was among those who took initial steps to open up such an analysis. In his 1992 book *Society and Nature: Towards a Green Social Theory*, he focused on Marx's early writings, such as the *Economic and Philosophic Manuscripts*, insisting that this work provides key insights into how the organization, processes, and relations of the capitalist system alienated humanity from nature. He proposed that people's understanding of nature tends to be shaped by their lived experiences within a society dominated by commodity production. Although some of the baggage of first-stage ecosocialism, such as an assumption that Marx in his mature works largely ignored natural limits and promoted an extreme productivism, still remained, Dickens's work nonetheless represented a turning point. He was critical of simply grafting deep-ecology positions onto a revised Marxism. He insisted on the need to extend Marx's method, which included both a historical-materialist and dialectical assessment of the relationship between society and nature. From a critical-realist orientation, he explained that larger emergent properties and boundaries within the biophysical world must be recognized, and that the capitalist system was "overloading these self-regulating ecosystems and stretching them to a point at which they [could] no longer cope."⁶⁴

Second-stage ecosocialist scholarship called into question the tendency to pit the young Marx against the mature Marx, Marx against Engels, and natural science against social science. Paul Burkett explained that elemental ecological ideas ran throughout Marx's work, even though the language in which he expressed them changed. Marx had moved over the course of his studies from highly "abstract" to "more consistently historical and social-relational" concepts.⁶⁵ Burkett also pointed out that Marx and Engels were both committed to a "materialist and social-scientific approach to nature," which served as the basis for extending and developing their analysis, creating opportunities for complementary work between the social and natural sciences.⁶⁶ In other words, they insisted upon employing both a materialist conception of history and a materialist conception of nature as necessary counterparts.⁶⁷

Their efforts to analyze the interactions and transformations in the dialectical nature-society relationship was greatly enhanced by Marx's use of metabolic analysis. Here Marx's critique of political economy merged with his assessment of ecological relations, illuminating the

interpenetration of nature and society, as well as the scale and processes through which these interactions had historically developed. Marx embedded socioeconomic systems in ecology and explicitly studied the interchange of matter and energy between the larger environment and society.⁶⁸ Ecological economist Marina Fischer-Kowalski has proposed that social-metabolic analysis, arising out of Marx's work, can illuminate the coupling of human and natural systems, because it "cut[s] across the 'great divide' between the natural sciences...and the social sciences."⁶⁹ The engagement and development of Marx's triadic scheme—metabolism of nature, social metabolism, and metabolic rift—helped solidify the second stage of ecosocialist analyses and served as the springboard for the third stage, with the result that this methodology is now widely used to address many of today's most pressing ecological challenges.

In developing his metabolic analysis, Marx drew on a long scientific and intellectual history. In the early nineteenth century, physiologists introduced the concept of metabolism to examine the biochemical processes between a cell and its surroundings, as well as the interactions and exchanges between an organism and the biophysical world. The physician and communist Roland Daniels, who was Marx's friend and comrade, extended the use of metabolism to whole complexes of organisms, foreshadowing its application in ecosystem analysis.⁷⁰ Although Daniels's work was not published for more than a century, due to his untimely death in his mid-thirties (he contracted pneumonia while in prison during the Cologne communist trials), the broad idea he represented would, through the investigations of other thinkers, become the basis for examining higher levels of organization and interdependency, including the interchange of matter and energy, between human societies and the larger environment. The German chemist Justus von Liebig helped generalize the concept of metabolism, using it to study the exchange of nutrients between Earth and humans.⁷¹ He explained that soil required specific nutrients—such as nitrogen, phosphorus, and potassium—to produce vegetation. As plants grew, they absorbed soil nutrients. To maintain soil fertility, these nutrients had to be recycled back to the land.

Marx, who closely followed scientific debates and discoveries, incorporated the concept of metabolism into his critique of political economy, explaining that he employed the word to denote "the 'natural' process of production as the material exchange [*Stoffwechsel*] between man and nature."⁷² He recognized that humans are dependent on nature and "can create nothing without" it.⁷³ For "the earth itself is a universal instrument...for it provides the worker with the ground beneath his feet and a 'field of employment' for his own particular process."⁷⁴ As a result, there

is a necessary “metabolic interaction” between humans and the earth. Labor serves as “a process between man and nature, a process by which man, through his own actions, mediates, regulates and controls the metabolism between himself and nature.”⁷⁵ The labor process, including exchanges with ecological systems, is influenced by the dominant economic systems and social institutions, defining what Marx saw as the social metabolism.

The complex, nuanced ecological worldview in Marx’s formulation is evident in his conception of both the “universal metabolism of nature” and the social metabolism.⁷⁶ The “universal metabolism of nature” stood for the broader biophysical world.⁷⁷ Specific cycles and processes constitute and help regenerate ecological conditions. Human society exists within the earthly metabolism, continually interacting with its external natural environment in the production of goods, services, and needs. As a result, the social metabolism operates within the larger universal metabolism. Under capitalist commodity production, this relationship takes on such an alienated form that it generates ecological crises, manifesting as a “rift” in the metabolism between society and nature (or disjunctures within both the social metabolism and the wider universal metabolism). This demands the “restoration” of these necessary conditions. “The natural boundary” to human production, as Lukács, following Marx, stated, “can only retreat, it can never fully disappear.”⁷⁸

Marx avoided subordinating nature to society, or vice versa, allowing him to elude “the pitfalls of both absolute idealism and mechanistic science.”⁷⁹ His metabolic analysis recognizes that humans and the rest of nature are in constant interaction, resulting in reciprocal influences, consequences, and dependencies. These processes emerge within a relational, thermodynamic, whole, the universal metabolism of nature.

Humans transform nature through production. However, “they do not do so just as they please; rather they do so under conditions inherited from the past (of both natural and social history), remaining dependent on the underlying dynamics of life and material existence.”⁸⁰ Each mode of production generates a distinct social metabolic order that influences the interchange and interpenetration of society and ecological systems.⁸¹ The social metabolic order of capital, for example, is expressed as a unique historical system of socio-ecological relations developed within a capitalist mode of social organization. Human social systems exchange with, work within, and draw on ecological systems in the process of producing and maintaining life and sociocultural conditions.

Yet within the social metabolic order of capital, this process materializes in a manner unlike other previous socio-ecological systems. The

practical activities of life are shaped by the expansion and accumulation of capital. Marxian economist Paul Sweezy explained that in their “pursuit of profit...capitalists are driven to accumulate ever more capital, and this becomes both their subjective goal and the motor force of the entire economic system.”⁸² The compulsion to accumulate leads to continuous cycles of creative destruction (and destructive creation), as novel productive and distributive methods are developed and exploitable resources expanded to power industry and manufacture commodities. The needs of capital are imposed on nature, increasing the demands placed on ecological systems and the production of wastes.

To illustrate such social-metabolic analysis, it is useful to consider how Marx, drawing on the work of chemists and agronomists, analyzed the transformations associated with capitalist agricultural production. He explained that soil “fertility is not so natural a quality as might be thought, it is closely bound up with the social relations of the time.”⁸³ In many precapitalist societies, farm animals were directly utilized in agricultural production. They were fed grains from the farm, and their nutrient-rich manure was reincorporated into the soil as fertilizer. People who lived in the countryside primarily consumed food and fiber from nearby farms. Their waste was likewise integrated into the nutrient cycle, helping maintain soil fertility.

This particular metabolic interchange was transformed in large part by the enclosure movement, the rise of the new industrial systems, and social relations associated with capitalist development. A wider, more alienated division between town and country emerged, as food and fiber from farms were increasingly shipped to distant markets, which transferred the nutrients from one location to another. The nutrients in food were squandered, and treated as mere waste accumulated as pollution within cities and rivers.⁸⁴ Liebig, in his *Letters on Modern Agriculture*, argued that these emerging social conditions contributed to the disruption of the soil nutrient cycle. In the introduction to the 1862 edition of his *Organic Agriculture in its Application to Chemistry and Physiology* (better known as *Agricultural Chemistry*), he described the modern intensive farming practices of Britain as a system of “robbery” that exhausted the nutrients within the soil.⁸⁵ In *Capital*, Marx similarly suggested that new agricultural practices, including the application of industrial power, increased the scale of operations, transforming and intensifying the social metabolism while exacerbating the depletion of the soil nutrients.⁸⁶

As a result, large-scale capitalist agriculture, Marx argued, progressively “disturbs the metabolic interaction between man and the earth.”⁸⁷ Along with the various mechanisms used to intensify production and

increase profits, it created a metabolic “rift” in the soil nutrient cycle, “robbing the soil” and “ruining the more long-lasting sources of that fertility.”⁸⁸ As it violated the universal metabolism associated with the soil nutrient cycle (also conceived as a law of restitution), the rift undermined soil fertility and the conditions that supported human society. These nutrients from the consumption of food and fiber in the urban centers of the capitalist world were lost to the soil, and were turned into mere waste polluting the cities.

Reflecting on the industrialization of farming, Marx lamented that “agriculture no longer finds the natural conditions of its own production within itself, naturally, arisen, spontaneous, and ready to hand, but these exist as an independent industry separate from it—and, with this separateness the whole complex set of interconnections in which this industry exists is drawn into the sphere of the conditions of agricultural production.”⁸⁹ In his discussion of “The Genesis of Capitalist Ground Rent” in volume three of *Capital*, he explained that the drive to capital accumulation “reduces the agricultural population to an ever decreasing minimum and confronts it with an ever growing industrial population crammed together in large towns; in this way it produces conditions that provoke an irreparable rift in the interdependent process of social metabolism, a metabolism prescribed by the natural laws of life itself. The result of this is a squandering of the vitality of the soil, which is carried by trade far beyond the bounds of a single country.”⁹⁰

In the nineteenth century, the rift in the soil nutrient cycle posed a significant environmental problem for European agriculture and societies. Numerous attempts were made to find affordable means of enriching the soil. Bones were ground up and spread across fields, and massive quantities of guano and nitrates were imported from Peru and Chile to Britain and other regions of the global North to sustain agricultural production.⁹¹ The social relations associated with this metabolic rift expanded from the local to the national and international levels, as the bounty of the countryside and distant lands was transferred to urban centers of the global North. Just prior to the First World War, the process for producing nitrates by fixing nitrogen from the atmosphere was developed, allowing for the large-scale production of artificial nitrogen fertilizer. Nevertheless, the failure to recycle nutrients still contributes to the ongoing depletion of soil by intensive agricultural practices. As a result, the metabolic rift in the soil nutrient cycle remains a persistent problem of the modern social metabolic order.⁹²

Dickens’s 2004 book *Society and Nature: Changing Our Environment, Changing Ourselves* highlighted the important advances of the second

stage of ecosocialism, especially the centrality of a historical-materialist conception of both nature and society, the nature-society dialectic, and metabolic analysis. He engaged a broad range of Marx's works, exploring the depth of Marx's ecology. He considered how distinct modes of production involved different demands and interactions with the larger environment, and explained—based on earlier research into “Marx's Theory of Metabolic Rift”—that “the notion of an ecological rift, one separating humanity and nature and violating the principles of ecological sustainability, continues to be helpful for understanding today's social and environmental risks.”⁹³ Importantly, Dickens showed how to extend this analysis to contemporary environmental problems, especially those associated with cities. He proposed that “three metabolic problems” plague modern cities, namely “the provision of an adequate water supply, the effective disposal of sewage and the control of air pollution.” These problems highlight how “humanity's metabolism with nature [is] not being ultimately destroyed but [is] being overloaded in the context of a particular kind of social and spatial organization.”⁹⁴

Marxist metabolic research continues to thrive. In many ways, as the late Del Weston argued in *The Political Economy of Global Warming*, the “metabolic rift is at the crux of Marx's ecological critique of capitalism, denoting the disjuncture between social systems and the rest of nature.”⁹⁵ It has been employed to analyze metabolic relations and ecological rifts in contemporary agricultural, climatic, oceanic, hydraulic, and forest systems.⁹⁶ Other theorists have used the concept of the metabolic rift, and Marx's ecological materialism in general, to develop a “Marxist ecofeminism” that explores the relation between rifts in nature and in gender relations.⁹⁷

Much of this work examines how the social metabolism of capitalism as a global system has created specific environmental problems in the modern era by transgressing the universal metabolism of nature. The intensification of the social metabolism demands more energy and raw materials, generating an array of ecological contradictions and rifts.⁹⁸ Other analysts consider how, as capitalism confronts environmental problems or obstacles—such as a shortage or exhaustion of particular natural resources—it pursues a series of shifts and technological fixes to maintain its expansion. In this way, environmental problems are addressed by incorporating new resources into the production process, changing the location of production, or developing new technologies to increase efficiency. Yet far from mending ecological rifts, such shifts often simply create new cumulative problems, generating additional disruptions on a larger scale.⁹⁹ It is clear that the required “metabolic restoration” necessitates

an ecological and social revolution to overturn the social metabolic order of capital—aimed at the creation of a higher society in which the associated producers rationally regulate the social metabolism in accord with the requirements of the universal metabolism of nature, while allowing for the fulfillment of their own human needs.¹⁰⁰

Marx and Nature in the Anthropocene: Toward a Critical Synthesis

Horkheimer and Adorno wrote the *Dialectic of Enlightenment* during the Second World War while in exile in the United States. They intended it as an account of the extreme domination of nature and domination of humanity that characterized all of the warring countries, all of which were in various ways heirs of the Enlightenment. It was followed several years later by Horkheimer's *Eclipse of Reason*, which argued that through fascism in Europe and social Darwinism in the United States, the domination of nature had provoked a "revolt of nature," which was being harnessed in reactionary ways to reinforce the domination of both nature and society. For Horkheimer, "whenever nature is exalted as a supreme principle and becomes the weapon of thought against thinking, against civilization, thought manifests a kind of hypocrisy, and so develops an uneasy conscience.... Indeed, the Nazi regime as a revolt of nature became a lie the moment it became conscious of itself as a revolt. The lackey of the very mechanized civilization [capitalism] that it professed to reject, it took over the inherently repressive measures of the latter."¹⁰¹

Social Darwinism emerged, Horkheimer argued, as "the main growth of the Enlightenment," and thus represented a repressive force harnessed to a naturalistic revolt against machine civilization, creating an even greater repression. The result, he wrote, was a huge Faustian tragedy. "The history of man's efforts to subjugate nature," he explained, "is also the history of man's subjection of man."¹⁰² Yet, he insisted, there was no going back: "We are the heirs, for better or worse, of the Enlightenment and technological progress. To oppose these by regressing to more primitive stages does not alleviate the permanent crisis they have brought about. On the contrary, such expedients lead from historically reasonable to utterly barbaric forms of social domination."¹⁰³ Projecting a highly abstract, idealist philosophical argument, he concluded that "the sole way of assisting nature is to unshackle its seeming opposite, independent thought."¹⁰⁴

It was in this context, as indicated above, that Schmidt wrote *The Concept of Nature in Marx*. As in Horkheimer and Adorno's work, Schmidt treated the dialectic of the Enlightenment as a form of the domination of nature, from which there was virtually no escape. Schmidt insisted that

Marx, like Hegel, saw the labor process as the mere “outsmarting and duping of nature.”¹⁰⁵ Even when Marx pointed, according to Schmidt, to nature as a “co-producer” with labor, it was in the context of the promotion of narrow human ends.¹⁰⁶ The needs of external nature were entirely “foreign” to Marx’s whole outlook. Bloch’s humane Marxian “philosophy of hope” was thus in reality a hopeless utopian quest, which turned into an empty “apocalyptic vision.”¹⁰⁷

Smith accepted the main formulations of Schmidt’s analysis, while inverting the Frankfurt School critique, and promoting the “production of nature” as the Marxian ideal—a view that Smith acknowledged could not be found in Marx himself. Here the problem of the domination of nature simply disappeared before the unceasing expansion of the human production of nature. He thus dismissed the environmental movement’s growing resistance to this unsustainable economic exploitation of nature as “left apocalypticism,” condemning such so-called “apocalypticism” even more absolutely than Schmidt had in his criticism of Bloch’s “apocalyptic vision.” Nature, in Smith’s view, was increasingly without any reality at all, outside of its production by human beings.¹⁰⁸

It is here, however, that we discover, by way of contrast to the social monism of the production of nature thesis, the liberatory potential that still lingered in the work of the more adamantly socialist-humanist thinkers associated with the Frankfurt School. For in their concern with the domination of nature alongside the domination of humanity, the more critical and praxis-oriented representatives of the Frankfurt School never ceased to notice the contradictions of capitalism and the possibility of transcending contemporary reality. At the very inception of the Institute for Social Research in Frankfurt, in 1932, Erich Fromm, in his seminal paper “The Method and Function of an Analytic Social Philosophy,” pointed to Marx’s notion of the labor process as a metabolic relation, an integrated dialectic of nature and society.¹⁰⁹ Here he underscored the significance of Bukharin’s 1925 book *Historical Materialism*, often dismissed for its mechanistic materialism, for its insight into this aspect of Marx’s analysis.

Georg Lukács, writing only a few years after *History and Class Consciousness* (in his *Tailism* manuscript of 1925–26)—though this reflected in part his break with Western Marxism—argued that a meaningful dialectics of nature in Marx was embodied in his theory of the labor process as the metabolic relation between humanity and nature. What is more, the fact that “human life is based on the metabolism with nature” meant, for Lukács, that “certain truths which we acquire in the process of carrying out this metabolism have a general validity.”¹¹⁰

Marcuse, the most directly ecological of the early Frankfurt School thinkers (though this was mainly manifested in his later writings), declared: "History is also grounded in nature. And Marxist theory has the least justification to ignore the metabolism between the human being and nature, and to denounce the insistence on this natural soil of society as a regressive ideological conception."¹¹¹

In Marcuse's more hopeful, dissenting Frankfurt School vision, rooted in Marx's *Economic and Philosophical Manuscripts*, it was possible to conceive of an ecologically based liberation movement. "What is happening," he wrote in *Counter-Revolution and Revolt*, "is the discovery (or rather rediscovery) of nature as an ally in the struggle against the exploitative societies in which the violation of nature aggravates the violation of man. The discovering of the liberating forces of nature and their vital role in the construction of a free society becomes a new force in social change."¹¹²

Dickens likewise drew inspiration from Marx's early writings, emphasizing in his early *Society and Nature: Towards a Green Social Theory* that a sociology of ecological liberation could be developed on the basis of the work of the young Marx. In his later book, *Society and Nature: Changing Our Environment, Changing Ourselves*, Dickens criticized Horkheimer and Adorno's "fearsome anti-Enlightenment critique" as sheer "pessimism."¹¹³ Instead, Dickens argued for a more positive, ecological-revolutionary vision, rooted in Marx's theory of metabolic rift. "Marx's early [naturalist-humanist] background," he observed,

led him to undertake no less than an analysis of what would now be called "environmental sustainability." In particular, he developed the idea of a "rift" in the metabolic relation between humanity and nature, one seen as an emergent feature of capitalist society.... The notion of an ecological rift, one separating humanity and nature and violating the principles of ecological sustainability, continues to be helpful for understanding today's social and environmental risks.¹¹⁴

The goal ultimately needed to be the creation of a sustainable and egalitarian society, able to "mend the 'metabolic rift' between nature and society."¹¹⁵

Still, not all on the left would agree with second-stage ecosocialists in this respect; nor with the need to focus on the question of the ecological rift or domination of nature engendered by capitalist society. According to Smith, writing in the 2007 *Socialist Register*, the Frankfurt School—referring mainly to Horkheimer, Adorno, and Schmidt—always dualistically conceived the "domination of nature" as "an inevitable condition of the human metabolism with nature." Similarly, "ecological essentialists [his term for radical ecologists generally] recognize a parallel attempt at

domination, but they see it not as inevitable but as a destructive social choice.” In sharp contrast, Smith’s own “production-of-nature thesis” rejected both of these so-called dualistic views: “The domination-of-nature thesis [encompassing both perspectives] is a cul-de-sac...the only political alternatives are an anti-social (literally) politics of nature or else resignation to a kinder, gentler domination.”¹¹⁶ For Smith, “The externality and universality of nature...are not to be taken as ontological givens. The ideology of external-cum-universal nature harks back to a supposedly edenic, pre-human, or supra-human world.”¹¹⁷

Indeed, Smith, in the name of combatting dualism, went so far as to dismiss the entire ecological struggle to mitigate climate change, writing: “In the end, the attempt to distinguish social [i.e., anthropogenic] vis-à-vis natural contributions to climate change is not only a fool’s debate but a fool’s philosophy: it leaves sacrosanct the chasm between nature and society—nature in one corner, society in the other—which is precisely the shibboleth of modern western thought that the ‘production of nature’ thesis sought to corrode. One does not have to be a ‘global warming denier’...to be a skeptic concerning the way that a global public is being stampeded into accepting wave upon wave of technical economic, and social change, framed as necessary for immediate planetary survival.”¹¹⁸ On this basis, he condemned what he called “the apocalyptic tone of imminent environmental doom,” associated with much of science and the environmental movement.¹¹⁹

By inverting the Frankfurt School’s critical domination of nature thesis, and turning that into an uncritical production of nature notion (a kind of anthropomorphic social monism), Smith, Castree, and other like-minded thinkers effectively de-naturalize social theory to an extreme, imposing ecological blinders.¹²⁰ What is excluded is a more developed, dialectical perspective, pointing to the alienation of nature under capitalism.

In contrast, the enduring value of Marx’s ecological materialism, incorporating such critical concepts as the universal metabolism of nature, the social metabolism, and the metabolic rift, is that it points in a co-evolutionary and co-revolutionary direction—highlighting the need for a new order of social metabolic reproduction rooted in substantive equality.¹²¹ Here social and natural necessity, natural science and social science, humanity and the earth *become one human-mediated totality*, in a wider universal struggle—one pointing to a revolutionary dialectic of humanity and the earth in which the necessary outcome is a world of sustainable human development. It is this higher synthesis of the various Marxian ecological and social critiques—building on the foundations of historical materialism—that we are most in need of today.

Notes

1. Russell Jacoby, "Western Marxism," in Tom Bottomore, ed., *A Dictionary of Marxist Thought* (Oxford: Blackwell, 1983); Fredric Jameson, *Valences of the Dialectic* (London: Verso, 2009), 6–7; John Bellamy Foster, Brett Clark, and Richard York, *The Ecological Rift* (New York: Monthly Review Press, 2010), 215–25.
2. Noel Castree, "Marxism and the Production of Nature," *Capital and Class* 72 (2000): 5–36; Neil Smith, *Uneven Development* (Athens: University of Georgia Press, 2008).
3. Paul Burkett, "Nature in Marx Reconsidered," *Organization & Environment* 10, no. 2 (1997): 164.
4. Alfred Schmidt, *The Concept of Nature in Marx* (London: New Left Books, 1970), 9.
5. Smith, *Uneven Development*, 31–2.
6. Max Horkheimer and Theodor W. Adorno, *The Dialectic of Enlightenment* (New York: Continuum, 1972).
7. Horkheimer and Adorno, *The Dialectic of Enlightenment*, 224.
8. Schmidt, *The Concept of Nature in Marx*, 154–55. The idea of a "reconciliation" of nature and humanity was a constant theme of the Frankfurt School. In practice, however, it took the form of negative criticisms of various ways of reconciling nature with humanity and society. See Martin Jay, *The Dialectical Imagination* (New York: Little, Brown, 1973), 267–73.
9. Frederick Engels, "Dialectics of Nature," in Karl Marx and Frederick Engels, *Collected Works*, vol. 25 (New York: International Publishers, 1975), 460–64; Schmidt, *The Concept of Nature in Marx*, 155–56, 160.
10. References here to the Frankfurt School's critique of the "dialectic of the Enlightenment" (and of Marx and nature) relate primarily to Schmidt, as well as to Horkheimer and Adorno. It excludes most notably—unless otherwise indicated—Herbert Marcuse, who, though reflecting some of the same tendencies, was to respond affirmatively and dialectically to the growth of environmentalism in the 1970s.
11. On Schmidt's criticisms of Bloch and Brecht, see Schmidt, *The Concept of Nature in Marx*, 124–28, 154–63. See also Bertolt Brecht, *Tales from the Calendar* (London: Methuen, 1966); Ernst Bloch, *The Principle of Hope*, vol. 1 (Cambridge, MA: MIT Press, 1986).
12. The first of the two polemical attacks was directly referred to by Schmidt. The second was not noted by Schmidt himself and was simply a product of his strict adherence to Western Marxism's criticism of dialectical materialism. Schmidt, *The Concept of Nature in Marx*, 9.
13. Schmidt recognizes the philosophical significance of Marx's view of nature as the ultimate source of all wealth, without realizing its importance to Marx's political-economic and ecological critique. Schmidt, *The Concept of Nature in Marx*, 77–78. On Marx's value theory and ecological critique, see Foster, Clark, and York, *The Ecological Rift*, 53–64.
14. Schmidt, *The Concept of Nature in Marx*, 76, 80, 88–90.
15. Schmidt, *The Concept of Nature in Marx*, 15, 59, 63–64, 90, 98, 139, 157, 162.
16. Schmidt, *The Concept of Nature in Marx*, 139.
17. Theodor W. Adorno, *Negative Dialectics* (New York: Continuum, 1973), 244.
18. John Bellamy Foster and Hannah Holleman, "Weber and the Environment," *American Journal of Sociology* 117, no. 6 (2012): 1660–62.
19. Horkheimer quoted in William Leiss, *The Domination of Nature* (Boston: Beacon, 1974), 154.
20. Max Horkheimer, *The Eclipse of Reason* (New York: Continuum, 1974), 123–27.
21. See Herbert Marcuse, *Counter-Revolution and Revolt* (Boston: Beacon, 1972), 59–78; *The Aesthetic Dimension* (Boston: Beacon, 1978), 16.
22. Schmidt, *The Concept of Nature in Marx*, 154.
23. Schmidt, *The Concept of Nature in Marx*, 156; see also Jay, *The Dialectical Imagination*, 259, 347.
24. "Western Marxism" arose as a specific tradition in the West, defined in part by its rejection of the dialectics of nature. See Jacoby, "Western Marxism," 523–26.
25. Leiss, *Domination of Nature*, 217.
26. Smith, *Uneven Development*, 44.
27. Burkett, "Nature in Marx Reconsidered," 173.
28. Schmidt, *The Concept of Nature in Marx*, 78–79.
29. Karl Marx, *Capital*, vol. 1 (New York: Vintage, 1976), 637.
30. Schmidt, *The Concept of Nature in Marx*, 11.
31. Schmidt, *The Concept of Nature in Marx*, 88.
32. Marx took his wider ecological notion of metabolism initially from the work of his friend the physician Roland Daniels, who may have been the first to point toward a larger ecosystemic perspective. See Roland Daniels, *Mikrokosmos* (New York: Peter Lang, 1988), 49. (Kohei Saito first brought this to our attention in personal correspondence. We are also grateful to Joseph Fracchia for his translations from the German in this regard). Later Justus von Liebig's analysis of the soil problem, in which he incorporated the metabolism concept, proved decisive for Marx. See the discussion in John Bellamy Foster, *Marx's Ecology* (New York: Monthly Review Press, 2000), 147–54; Kohei Saito, "The Emergence of Marx's Critique of Modern Agriculture: Ecological Insights from His Excerpt Notebooks," *Monthly Review* 66, no. 5 (October 2014): 25–46. Despite Schmidt's claim that Marx took his analysis of metabolism from Jacob Moleschott, there is no evidence of this, while considerable evidence suggests Marx's reliance on other thinkers. See Schmidt, *The Concept of Nature in Marx*, 86–88.
33. Schmidt, *The Concept of Nature in Marx*, 11, 76, 90, 176. Reiner Grundmann considered Marx's metabolism argument the strongest of the three approaches to ecological questions (the first being "capitalist production as a cause of ecological problems," and the second the alienation of nature). Yet Grundmann, like Schmidt, interpreted Marx's metabolism argument in simple instrumentalist-mechanistic terms, thereby losing sight of its complexity and missing the importance of Marx's theory of ecological crisis. See Reiner Grundmann, *Marxism and Ecology* (Oxford: Oxford University Press, 1991), 90–98, 121–22.
34. See Ted Benton, ed., *The Greening of Marxism* (New York: Guilford, 1996); Mark J. Smith, *Ecologism* (Minneapolis: University of Minnesota Press, 1998), 71–73.
35. Eric J. Hobsbawm, "Preface," in Brenda Swann and Francis Aprahamian, eds., *J.D. Bernal* (London: Verso, 1999), xix.
36. On the appropriation problem, see John Bellamy Foster, "Marx's Theory of Metabolic Rift," *American Journal of Sociology* 105, no. 2 (1999): 391–96.
37. Perry Anderson, *In the Tracks of Historical Materialism* (London: Verso, 1983), 83.
38. Russell Jacoby sees the split that occurred in Marxism in terms of their distinct appropriations of Hegel. "Soviet Marxism," he wrote, "was regularly sustained by a scientific Hegel, and European Marxism was regularly sustained by a historical Hegel." See Russell Jacoby, *The Dialectic of Defeat* (Cambridge: Cambridge University Press, 1981), 57–58.
39. Ted Benton, "Marxism and Natural Limits," *New Left Review* 178 (1989): 55, 60, 64.
40. André Gorz, *Capitalism, Socialism, Ecology* (London: Verso, 1994), vii–9, 29, 100; Gorz, *Ecology as Politics* (London: Pluto, 1983).
41. James O'Connor, *Natural Causes*

- (New York: Guilford, 1998), 160.
42. Alain Lipietz, "Political Ecology and the Future of Marxism," *Capitalism Nature Socialism* 11, no. 1 (2000): 74-75.
43. Michael Redclift, *Development and the Environmental Crisis* (New York: Methuen, 1984), 7.
44. Karl Marx, *Capital*, vol. 3 (New York: International Publishers, 1967), 745; see also Paul Burkett, "Nature's 'Free Gifts' and the Ecological Significance of Value," *Capital and Class* 23 (1999): 89-110; Bukett, "Nature in Marx Reconsidered," 173-74.
45. Ted Benton, "Introduction to Part Two," in Benton, ed., *The Greening of Marxism*, 103-10.
46. Castree, "Marxism and the Production of Nature," 27-28.
47. Castree, "Marxism and the Production of Nature," 28; Noel Castree, "Marxism, Capitalism, and the Production of Nature," in Noel Castree and Bruce Braun, eds., *Social Nature* (Malden, MA: Blackwell, 2001), 204-05.
48. Castree points to these contradictions in Smith's analysis, while nonetheless arguing that Smith's approach to the production of nature is basically the one on which Marxian theorists should build—if in a more nuanced way.
49. Smith, *Uneven Development*, 31, 44-47, 78-91, 244-47; Neil Smith, "Nature as an Accumulation Strategy," *Socialist Register 2007* (New York: Monthly Review Press, 2006), 23-28.
50. Smith, *Uneven Development*, 31.
51. Smith, *Uneven Development*, 247.
52. Noel Castree, "The Nature of Produced Nature: Materiality and Knowledge Construction in Marxism," *Antipode* 27, no. 1 (1995): 16-18.
53. Castree, "The Nature of Produced Nature," 17.
54. Castree, "Marxism and the Production of Nature," 9-10, 21.
55. Castree, "Marxism and the Production of Nature," 8. It should be noted that since Smith and Castree had already faulted Marx for being dualistic, what ecosocialists were actually being charged with here was not a misinterpretation of Marx, but a failure to conform to Smith's own monistic production of nature thesis. Contrary to such views, our own assessment is that neither Marx nor his major followers were dualistic. Rather, what Smith and Castree in their mechanistic-monistic worldviews mistook for dualism was really a dialectical analysis of the interpenetration of opposites.
56. Castree, "Marxism and the Production of Nature," 17.
57. Castree, "Marxism and the Production of Nature," 13-15; and "The Nature of Produced Nature," 20-21, 24. Castree refers abstractly here to the "materiality of nature" but denies its "externality" or "universality," which he characterizes as "essentialist."
58. Castree, "Marxism and the Production of Nature," 17; Jason W. Moore, *Capitalism in the Web of Life* (London: Verso, 2015), 46, 80-86.
59. See William R. Catton Jr. and Riley E. Dunlap, "Environmental Sociology: A New Paradigm," *American Sociologist* 13 (1978): 41-49; John Bellamy Foster, "The Planetary Rift and the New Human Exemptionalism," *Organization & Environment* 25, no. 3 (2012): 1-27.
60. Noel Castree, "Capitalism and the Marxist Critique of Political Ecology," in Tom Perreault, Gavin Bridge, and James McCarthy, eds., *The Routledge Handbook of Political Ecology* (London: Routledge, 2015), 291; Michael Shellenberger and Ted Nordhaus, *Break Through* (New York: Houghton Mifflin, 2007).
61. Castree, "Capitalism and the Marxist Critique of Political Ecology," 291.
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112. Marcuse, *Counter-Revolution*, 59-60.
113. Dickens, *Society and Nature: Changing Our Environment*, 10.
114. Dickens, *Society and Nature: Changing Our Environment*, 80.
115. Dickens, *Society and Nature: Changing Our Environment*, 144.
116. Smith, "Nature as an Accumulation Strategy," 24-25.
117. Smith, "Nature as an Accumulation Strategy," 23.
118. Smith, *Uneven Development*, 244.
119. Smith, "Nature as an Accumulation Strategy," 27-29; Smith, *Uneven Development*, 247.
120. See Moore, *Capitalism in the Web of Life*, 85-86. Moore presents a social "monist and relational" view, rooted in a metaphorical concept of "singular metabolism," and defined in terms of "bundled" society-nature relations, in which he equates capitalism and "world ecology," rejecting Marx's own theory of metabolic rift.
121. On coevolution, see Richard B. Norgaard, *Development Betrayed* (London: Routledge, 1994). On co-revolution, see David Harvey, *The Enigma of Capital* (Oxford: Oxford University Press, 2010), 228-31. On a new order of social metabolic reproduction, see Mészáros, *Beyond Capital*, 170-77.



Or does Critical Criticism believe that it has reached even the *beginning* of a knowledge of historical reality so long as it excludes *from* the historical movement the theoretical and practical relation of man to nature, i.e. natural science and industry? Or does it think that it actually knows any period without knowing, for example, the industry of that period, the immediate mode of production of life itself? Of course, spiritualistic, *theological* Critical Criticism only knows (at least it imagines it knows) the main political, literary and theological acts of history. Just as it separates thinking from the senses, the soul from the body and itself from the world, it separates history from natural science and industry and sees the origin of history not in vulgar *material* production on the earth but in vaporous clouds in the heavens.

—KARL MARX & FREDERICK ENGELS, *Collected Works*, vol. 4, 150