

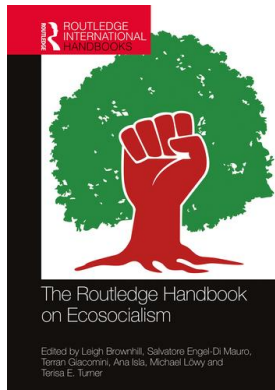
This article was downloaded by: 10.3.97.143

On: 23 Sep 2023

Access details: *subscription number*

Publisher: *Routledge*

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: 5 Howick Place, London SW1P 1WG, UK



The Routledge Handbook on Ecosocialism

Leigh Brownhill, Salvatore Engel-Di Mauro, Terran Giacomini, Ana Isla, Michael Löwy, Terisa E. Turner

Marx's Ecology and Metabolic Analysis

Publication details

<https://www.routledgehandbooks.com/doi/10.4324/9780429341427-10>

Brett Clark, John Bellamy Foster

Published online on: 28 Dec 2021

How to cite :- Brett Clark, John Bellamy Foster. 28 Dec 2021, *Marx's Ecology and Metabolic Analysis from: The Routledge Handbook on Ecosocialism* Routledge

Accessed on: 23 Sep 2023

<https://www.routledgehandbooks.com/doi/10.4324/9780429341427-10>

PLEASE SCROLL DOWN FOR DOCUMENT

Full terms and conditions of use: <https://www.routledgehandbooks.com/legal-notices/terms>

This Document PDF may be used for research, teaching and private study purposes. Any substantial or systematic reproductions, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The publisher shall not be liable for an loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

8

MARX'S ECOLOGY AND METABOLIC ANALYSIS

Brett Clark and John Bellamy Foster

Introduction

A planetary emergency looms over the twenty-first century as the ecological crisis increases in scale and severity, threatening human civilization with self-extinction. This situation is primarily due to the operation of a system predicated on ever-expanding capital accumulation and exponential economic growth. This drive has resulted in the transgression and crossing of planetary boundaries that define “a safe operating space for humanity,” such as climate change, ocean acidification, loss of biological diversity, diminished availability and quality of fresh water, land cover change (e.g., deforestation), the rupture of the nitrogen and phosphorus cycles, and increasing pollution from synthetic chemicals, which leads to the bioaccumulation and biomagnification of toxins within living organisms and across the food chain (Rockström et al. 2009; Steffen et al. 2015). It has manifested in an ecological moment of truth, the “Great Capitalist Climacteric,” whereby humanity either proceeds further down a path of ecological destruction, undermining the conditions of life, or radically shifts its productive relations as part of an ecological revolution to forge a sustainable society (Foster 2015).

Ecological Marxism offers critical insights for understanding the emergence and development of the “anthropogenic rift in the natural history of planet earth” (Foster 2000; Hamilton and Grinevald 2015, 67). As Karl Marx stressed, reflecting on the alienation of nature,

it is not the unity of living and active humanity with the natural, inorganic conditions of their metabolic exchange with nature, and hence their appropriation of nature, which requires explanation . . . but rather the separation between these inorganic conditions of human existence and this active existence, a separation which is completely posited only in the relation of wage labor and capital.

(Marx 1973, 489)

It is this historical separation in material reality accompanying capitalist development that has generated the “irreparable rift” between society and nature (Marx 1981, 949).

From the late 1990s on, metabolic rift scholarship has helped establish a rich tradition within ecological Marxism. By returning to Marx to address earthly questions, it has excavated the ecological foundations of classical historical materialism. It has detailed how Marx's

materialist conception of history was inseparably bound to his materialist conception of nature, forming a dialectical unity. It has identified, assessed, and developed the ecological analysis found within the work of Marx, exploring how this open, dialectical, materialist approach informed and was integrated into the scientific analyses and social critiques that followed. It has demonstrated how Marx's political-economic and ecological critiques of capitalism are unified, revealing how ecological relations and concerns are part and parcel of any discussions of value analysis, accumulation, labour, alienation, history, human needs, and socialism. It has involved an extensive examination and extension of Marx's metabolic analysis of the material exchanges between human society and nature, focusing on how capitalism, given its relentless drive to accumulation, produces ecological (metabolic) rifts as it transgresses against natural limits and the workings of ecosystems (Burkett 1999; Foster 2000, 2020; Foster, Clark, and York 2010; Saito 2014).

Marx's triadic metabolic scheme

Marx actively incorporated scientific concepts and knowledge into his analysis as he embedded human society within the larger biophysical world, paying particular attention to the historical interchange of matter and energy (Foster 2000; Foster and Burkett 2016). In the early nineteenth century, physiologists introduced the concept of metabolism in reference to the biochemical processes between cells and their surrounding environment. Marx's friend Roland Daniels, a physician, extended the use of metabolism to conceive of the interactions and exchanges taking place within whole complexes of organisms, serving as the basis for examining the metabolic relations and processes at higher levels of organization and interdependency (Foster and Clark 2020, 19, 206–207; Saito 2014). The German chemist Justus von Liebig (1859, 175–183, 220) employed the concept of metabolism, exploring the exchange of nutrients between earth and humans. As part of defining the soil nutrient cycle, he explained that specific nutrients – such as, but not limited to, nitrogen, phosphorus, and potassium – are needed to produce vegetation. He detailed how plants absorbed these nutrients as they grew. Thus, maintaining the health and fertility of the soil required recycling these nutrients back to the land.

Following this work, Marx integrated the concept of metabolism into his critique of political economy. He explained that there is a necessary “metabolic interaction [*Stoffwechsel*]” between humans and the earth and that labour is “a process by which man, through his own actions, mediates, regulates and controls the metabolism between himself and nature” (Marx 1976, 283, 290; see also, Marx 1975b, 133, 209; Marx and Engels 1975, vol. 24, 553). He put forward a groundbreaking metabolic analysis as part of his dialectical approach, which involves a triadic scheme consisting of “the universal metabolism of nature,” the “social metabolism,” and the “metabolic rift” (Foster 2013). Within this framework, he studied the historical mediation of the relations between humans and nature as part of an open, dialectical totality.

“The universal metabolism of nature” represents the broader biophysical world, including specific cycles and processes within the earth system that produce and regenerate ecological conditions (Foster 2013; Marx and Engels 1975, vol. 30, 54–66). All life depends on and interacts with this earthly metabolism, which constitutes specific boundaries. The social metabolism, which operates within and in relation to the universal metabolism, comprises the productive activities of human societies. For “all forms of society,” Marx argued (1976, 133), “labor, then, as the creator of use-values, as useful labor, is . . . an eternal natural necessity which mediates the metabolism between man and nature, and therefore human life itself.” This relationship of interchange is shaped by the historically specific political-economic organization of labour and production.

Under the capital system, “the social metabolic process” is directed towards “the real exchange of commodities,” whereby the productive exchange with nature is organized to expand profits, resulting in “a transformation in which the dual nature of the commodity – commodity as use-value and as exchange-value – manifests itself” (Marx 1970, 51–52, 86). The social metabolism takes on an alienated form, given that the quantitative expansion of capital is supreme, progressively transgressing and violating the boundaries associated with the universal metabolism, resulting in ecological rifts in the metabolism of society and nature. Importantly, Marx and Frederick Engels eschewed reductively subsuming society into nature (considering it an emergent form of nature), as well as vice versa. They thus avoided the dangers “of both absolute idealism and mechanistic science” (Foster 2000, 250–251, 2013, 8; Napoletano et al. 2018). Marx’s historical, metabolic analysis recognized the constant interactions and emergent consequences. He employed this integrative approach in his analysis of capitalist agricultural production and the ecological problem associated with the soil nutrient cycle.

Expropriation and the metabolic rift

To understand the crisis associated with soil fertility in the 1850s and 1860s, Marx extensively studied the work of Liebig, as well as Henry Carey, James F. W. Johnston, Carl Fraas, and Wilhelm George Friedrich Roscher (Foster 2000, 149–163; Saito 2014). Liebig (1859, 175–177) argued that British high-farming was systematically “alienating the crops” as the essential soil nutrients were being stripped away to supply food and fiber for distant markets. The failure to recycle lost nutrients, violating the “law of compensation,” was compromising the mineral composition of cultivated fields (Liebig 1859, 254–255, 1863, 233). He explained that this situation was the primary factor leading to the “exhaustion” of the soil (Liebig 1859, 175–177, 220, 230, 1863, 180, 210). To maintain agricultural production and enrich the fields, capitalist farmers in Great Britain and other leading European countries imported massive quantities of bones, seeds for oil cakes, guano, and nitrates from abroad, without changing the social conditions that were draining soil nutrients. Liebig described the rise of industrial capitalist agriculture, its intensive techniques to increase production, and its plundering of distant lands as a “robbery system” that was despoiling the earth (Clark and Foster 2009; Foster and Clark 2020; Liebig 2018). “Great Britain,” he argued, “robs all countries of the conditions of their fertility. . . . She hangs like a vampire on the neck of Europe, and seeks out its hearts-blood, without any necessity and without permanent benefit to herself” (Liebig 1862, 85). This alienated metabolic relation, which treated “the Earth” as if it was “inexhaustible in its gifts,” was counter to the “rational husbandry” that was necessary for maintaining the long-term productivity of the land (Liebig 1862, 96, 101, 1863, 233).

Marx integrated these insights into his more comprehensive and systematic analysis regarding world history, the historical development of capital, the alienation of nature, and the ecological contradictions of capitalism. As part of identifying and analyzing the “irreparable rift” between society and nature under capitalism, Marx was determined to understand the historic changes in the social metabolism throughout human history, deepening and expanding his ecological studies (Foster, Clark, and Holleman 2020; Saito 2017). This led him to conduct extensive studies of natural and communal economies, both past and present, in Europe, pre-Columbian America, Asia, Africa, and Australia, using ethnological works by Hubert Howe Bancroft, John Lubbock, John Budd Phaer, Maxim Kovalevsky, Henry Sumner Maine, Georg Ludwig von Mauer, Lewis Henry Morgan, and numerous others. In his notes, letters, and *Ethnological Notebooks*, which contain extensive excerpts and interpolations, Marx detailed the diversity of common property relations and the communal organization of these societies, as well as the tensions and

transformations associated with European colonialism (Marx 1974b, 1975a, 1983). Marx was especially interested in the “natural economy” of Indigenous peoples in the Americas, particularly the Incas. In the *Grundrisse* and the first volume of *Capital*, he emphasized that the land had not been alienated in these societies and communal exchange, rather than commodities, was the basis of the natural economy (Foster, Clark, and Holleman 2020).

While these natural economies varied from locality to locality, as well as historically, they were rooted in collective property and established social relations with the land, organized to meet the immediate needs of the communities. In England, the rights to the commons – which included common fields, meadows, marshes, streams, and woodlands – were enshrined in the thirteenth century in the *Magna Carta* and the *Charter of the Forest*. These rights were predicated on maintaining relations and activities that contributed to the collective reproduction of communities, which created a diversified, makeshift, subsistence economy, based on use values. Historian Peter Linebaugh (2008, 44–45, 59, 289) indicates that “common rights are embedded” within the specific ecologies of various locations, whereby commoners have a collective responsibility to organize their social metabolic relations in ways to take care of the land and people. As Engels (1978, 77–83) noted in his study of the Mark, in the early German system of communal association, this entailed manuring the fields with dung from cattle and sheep to enrich the soil.

In the section “So-Called Primitive Accumulation” in the first volume of *Capital*, Marx emphasized that the expropriation of the land and people throughout the world took place through the enclosure of the commons and colonialism, serving as the preconditions for the agricultural and Industrial Revolutions in the seventeenth and eighteenth centuries. He detailed the five phases of the long enclosure moment, from the late fifteenth century to the early nineteenth century, which progressively privatized the land, dismantled common rights, annihilated the peasantry, and severed the social relations that connected commoners to the land (Foster, Clark, and Holleman 2021; Marx 1976, 873–940). Coinciding with the enclosures, from the long sixteenth century and after, European colonialism decimated many natural economies via extreme forms of expropriation, such as “the extirpation, enslavement and entombment in mines of the indigenous population” in the Americas, the transatlantic slave trade, and the “conquest and plunder of India” (Marx 1976, 915). Marx detailed how the genesis of both the capitalist farmer and industrial capitalist is rooted in expropriation of nature and people. These processes helped give rise to a distinct social metabolism, associated with the capital system, in which private riches subordinated public wealth (Foster, Holleman, and Clark 2020; Mészáros 1995).

This new alienated social metabolism played a major role creating a soil crisis in the nineteenth century. Marx understood that soil fertility was influenced by the productive relations people had with the land. The enclosure movement, the changes in property rights, the division between town and country, the proletarianization of the peasants, the new industrial system, the application of novel agricultural techniques, and the drive to maximize profits reorganized the metabolic interchange. Capitalist farmers cleared the land of trees to create more uniformity, making it easier to incorporate machinery to cultivate the land and to increase the scale of operations (Marx 1976, 908; Morton 1859). These intensive efforts increased the rate at which nutrients were being extracted from the soil. Food and fiber were shipped to distant markets, transferring the nutrients to cities to feed and clothe the concentrated population. In the third volume of *Capital*, Marx highlighted the ecological contradictions that were emerging in relation to the social metabolism of capitalist agriculture:

We have both the excrement produced by man’s natural metabolism and the form in which useful articles survive after use has been made of them. . . . The natural human

waste products, remains of clothing in the form of rags, etc. are the refuse of consumption. The latter are of the greatest importance for agriculture. But there is a colossal wastage in the capitalist economy in proportion to their actual use.

(Marx 1981, 195)

The nutrients necessary to maintain soil fertility accumulated as waste within cities, leading to concerns regarding sanitation and disease. While detailed proposals were made to capture and return the nutrients to the countryside, such endeavours were not profitable. Thus, the nutrients ended up creating a pollution problem (Angus 2018; Clark and Longo 2018).

By failing to recycle soil nutrients, capitalist agriculture was violating the “law of compensation.” As a result, Marx (1976, 637) indicated that it was progressively disturbing “the metabolic interaction between man and the earth,” preventing “the return to the soil of its constituent elements consumed by man in the form of food and clothing; hence it hinders the operation of the eternal natural condition for the lasting fertility of the soil.” In other words, these conditions were creating “an irreparable rift in the interdependent process of the 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” (Marx 1981, 949).

This ecological rift, Marx (1973, 527) stressed, was a consequence of the destruction of “self-sustaining agriculture” as profit-driven industrial agriculture arose, transgressing against the earthly metabolism of the soil nutrient cycle. As a result, “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,” thus requiring “machinery, chemical fertilizer acquired through exchange, seeds from distant countries.” In an effort to replenish the land with needed nutrients, bones from battlefields across Europe and from the catacombs in Sicily were ground up and spread across agricultural land (Márald 2002, 74). Between 1840 and 1880, millions of tons of Peruvian guano, extracted by Chinese labourers as *de facto* slaves as part of ecological imperialism, were shipped to Great Britain and other countries in the global North to enrich exhausted fields (Clark, Auerbach, and Zhang 2018; Clark and Foster 2009). Even the mass production of synthetic fertilizer in the twentieth century has not been able resolve the metabolic rift in the soil nutrient cycle, given the growth imperative of capital, the failure to recycle nutrients, and the intensification of agricultural practices (Magdoff 2011; Mancus 2007). This problem persists, given the very logic of capital and its social metabolism. As Marx emphasized,

All progress in capitalist agriculture is a progress in the art, not only of robbing the worker, but of robbing the soil; all progress in increasing the fertility of the soil for a given time is progress towards ruining the more long-lasting sources of that fertility. Capitalist production, therefore, only develops the technique and the degree of combination of the social process of production by simultaneously undermining the original sources of all wealth – the soil and the worker.

(Marx 1976, 638)

Deepening and expanding Marx's ecology

Ecological Marxism continues to burgeon on multiple fronts, deepening and expanding Marx's ecological analyses, extending metabolic analysis, and addressing many of the most pressing ecological challenges today. Andreas Malm (2018, 177) contends that the scholarship on Marx's ecology and metabolic rift is one of immense “creativity and productivity.” A critical part

of this work involves the ongoing exploration, recovery, and development of Marx's historical-materialist, dialectical approach.

Paul Burkett (1999) has demonstrated how Marx's critique of capital incorporates rich ecological insights, which are integrated throughout his analysis of political economy. He illuminates Marx's understanding of natural limits and the expropriation of nature and the sophistication of Marx's value analysis for revealing the ecological contradictions of capital (for further discussion of value, see Foster and Burkett 2018). Additional work offers an extensive investigation of Marx and Engels's assessments of the science and debates regarding energy and thermodynamics, especially as these related to questions regarding the economy and labour (Foster and Burkett 2016).

Ecological Marxism is benefitting from integrating and building on important scholarship on imperialism, racial capitalism, settler colonialism, and social reproduction (Bhattacharya 2017; Beckert 2014; Coulthard 2014; Cox 1964; Du Bois 1992; Dunbar-Ortiz 2014; Estes 2019; Federici 2004; Fraser 2014, 2016; Salleh 2010). This work is revealing the historical and ongoing role of the expropriation of nature and people in relation to interlocking forms of oppression and inequalities that have been figurative in the emergence and development of capitalism. It has led to extensive studies of Marx's analysis of the historic economic and ecological robbery of Ireland by Britain, which culminated in widespread environmental disruption and extermination in the nineteenth century (Flaherty 2013; Foster and Clark 2020; Slater 2018a, 2018b; Slater and McDonough 2008). It has generated further exploration of Marx's analysis of natural economies, his critique of the genocide of Indigenous peoples throughout the world, his examination of the political economy of slaveowner capitalism, his analysis of how capital expropriates reproductive work, and his critique of alienated speciesism (Foster and Clark 2020; Foster, Clark, and Holleman 2020; Foster, Holleman, and Clark 2020; Fraser 2014, 2016). This exploration of the hidden abodes of capitalism is offering a more comprehensive understanding of the relationships between expropriation and exploitation, which define the system.

This body of research offers rich analyses of how classical historical materialism's open, dialectical, materialist ecological approach continued to develop, though primarily in the "second foundation" represented by natural science, throughout the nineteenth and twentieth centuries (Foster 2020, 7; see also Angus 2017; Empson 2013; Flaherty 2019; Saito 2017). Through this work, it is clear that Marx's ecology and metabolic analysis has a long lineage within both the natural and social sciences. In fact, socialist engagement and contributions have been central to the historical development of ecological science and ecology as a field of study (Foster 2020). Burkett (2006) illuminates how the integration of Marxist political economy into ecological economics can greatly enrich the field, positioning it to address the most pressing environmental problems. The significance of Marx's conception of labour as a metabolic relation, an integrated dialectic of nature and society, was recognized by Erich Fromm (1970, 153–154), Georg Lukács (2003, 96, 106, 113–114, 130–131), and Herbert Marcuse (1978, 16). French Marxist Henri Lefebvre (2016) drew directly on Marx's theory of metabolic rift in describing how the capital system was leading to total alienation and ecological destruction (see also Foster, Clark, and Holleman 2020; Napoletano et al. 2020).

The significance of metabolic rift research has become increasingly apparent. As Del Weston contends,

the metabolic rift permeates our dominant and pervasive acquisitive and technocratic thinking whereby human beings are conceptualised as being apart from nature, exempt from nature's laws, where it is believed that science and technology and human activities can dominate, manipulate and control nature, and that we find expression and

satisfaction through external, material goods. . . . [I]t denotes the disjuncture between social systems and the rest of nature.

(Weston 2014, 66)

She stresses that “the rift between humans and nature (and humans as nature) is manifested in many different ways” (ibid., 67). Thus, metabolic rift research continues to evolve, studying how the social metabolism of capitalism is producing ecological ruptures and shifts on numerous fronts, culminating in the planetary emergency in the twenty-first century (Clark and York 2008).

In *Fossil Capital*, Andreas Malm (2016) provides an extensive historical-materialist analysis of the rise of steam power and how the burning of fossil fuels has come to reside at the heart of capital. Through this development, capitalism is generating a metabolic rift in the carbon cycle via the constant burning of fossil fuels, the degradation of the carbon sinks (e.g., deforestation), and the flooding of the atmosphere with greenhouse gas emissions (Angus 2016; Clark and York 2005; Foster 2019; Klein 2014; Weston 2014). This rift is only amplified as the social metabolic order of capital demands more energy and raw materials for generalized commodity production (Burkett 2006; Dickens 2014; Foster, Clark, and York 2010).

Metabolic rift research has been extended to overlooked realms, such as marine systems, examining how the social metabolism of capitalism is altering ecosystem dynamics and life cycles (Longo and Clark 2016). For instance, the capital accumulation process plays a primary role in the structure and function of the fishing industry as prized fish are commodified for the global market (Longo, Clausen, and Clark 2015). Fish are being harvested at a rate faster than they can reproduce, which is contributing to the collapse of fisheries (Clausen and Clark 2005; Longo 2012). Recent analysis has focused on the social metabolism associated with capitalist food production. Concentrated animal feeding operations separate animals from pasture, as well as fish from marine systems. Feed is grown on distant land or captured at sea and transferred to animal production sites. Animal wastes, including important soil nutrients, accumulate in cesspools, polluting water systems (Carolan 2012; Clausen and Clark 2005; Clow and McLaughlin 2007; Longo, Clausen, and Clark 2014; Weis 2007). These operations enhance the ability of corporate enterprises to control the entire life cycle of animals in an attempt to decrease the time between birth and slaughter. At the same time, these enterprises are able to increase commodity production but, more importantly, increase value. Factory farms require massive amounts of animal feed, growth hormones, and antibiotics. They also generate enormous quantities of waste not readily reincorporated into ecosystems, creating ecological rifts on numerous fronts (Gunderson 2011).

Another area of investigation within this tradition has been forest ecology, including the ecological and temporal contradictions associated with capitalist logging practices, whereby the focus on short-term profits violates the regenerative requirements associated with the earthly metabolism of sustaining forests (Auerbach and Clark 2018). It has analyzed how white settler colonialism, racial capitalism, and capitalist agricultural development produced dust bowls that devastated the United States in the 1930s (Holleman 2018). Ecological Marxists, in pursuing metabolic rift analysis, have recovered Marx's food regime theory (Foster and Clark 2020, 113–125; Wallace 2020, 109). They have detailed how the capitalist global food system is destroying ecosystems and decimating wildlife in ways that are facilitating the spread of diseases from other animals to humans, which manifest in novel viruses and contributed to the COVID pandemic (Wallace 2016, 2020; Wallace et al. 2020). One line of inquiry presents how these social and ecological disruptions are creating corporeal rifts, including within the human microbiome (Foster and Clark 2020; Friedman 2018).

As a dynamic system constantly seeking to expand accumulation, capital inevitability confronts natural limits and transgresses against environmental obstacles associated with the earthly metabolism. Metabolic rift scholars detail how capital responds by geographically shifting extraction and production, employing technological fixes, and/or incorporating new resources as substitutes for other raw materials. Through these actions, capital avoids attending to the metabolic rifts it generates, often shifting them around while expanding the scale and scope of environmental degradation (Clark and York 2008; Foster, Clark, and York 2010; Napoletano, Paneque-Gálvez, and Vieyra 2015; Napoletano et al. 2019). Weston (2014, 67) stresses that ecological rifts are continuing to grow “in dimensions and complexity, to the point where economic activities of human society are causing unprecedented change in the Earth’s biosphere, its lands, forests, water and air.” The hyper-disruptive social metabolism of capital represents an “alienated mediation” of nature and society, one with potentially irreversible, catastrophic impacts, undermining the very conditions of life itself (Marx 1974a, 260–261).

Capitalism is antithetical to sustainability, as its logic leads to “exterminism” (Angus 2016, 179–180; Foster 2020, 525–526; Thompson 1982, 64). Ecological ruin or ecological revolution is the choice associated with the Great Capitalist Climacteric. The future of humanity depends on creating a long social and ecological revolution, in which associated producers are able to create a new social metabolism, one in accord with the requirements of the universal metabolism of nature. Ecological sustainability, substantive equality, and the restoration of the associated producers as the self-mediating beings of nature regulating the human metabolism with nature constitute the only possible bases of future social advance: *ecosocialism*.

References

- Angus, Ian. 2016. *Facing the Anthropocene*. New York: Monthly Review Press.
- Angus, Ian. 2017. *A Redder Shade of Green*. New York: Monthly Review Press.
- Angus, Ian. 2018. “Cesspools, Sewage, and Social Murder.” *Monthly Review* 70 (3): 32–68.
- Auerbach, Daniel, and Brett Clark. 2018. “Metabolic Rifts, Temporal Imperatives, and Geographical Shifts.” *International Critical Thought* 8 (3): 468–486.
- Beckert, Sven. 2014. *Empire of Cotton*. New York: Vintage.
- Bhattacharya, Tithi, ed. 2017. *Social Reproduction Theory*. London: Pluto.
- Burkett, Paul. 1999. *Marx and Nature*. New York: St. Martin’s Press.
- Burkett, Paul. 2006. *Marxism and Ecological Economics*. Leiden: Brill.
- Carolan, Michael. 2012. *The Sociology of Food and Agriculture*. New York: Routledge.
- Clark, Brett, Daniel Auerbach, and Karen Xuan Zhang. 2018. “The Du Bois Nexus.” *Environmental Sociology* 4 (1): 54–66.
- Clark, Brett, and John Bellamy Foster. 2009. “Ecological Imperialism and the Global Metabolic Rift.” *International Journal of Comparative Sociology* 50 (3–4): 311–334.
- Clark, Brett, and Richard York. 2005. “Carbon Metabolism.” *Theory and Society* 34 (4): 391–428.
- Clark, Brett, and Richard York. 2008. “Rifts and Shifts.” *Monthly Review* 60 (6): 13–24.
- Clark, Brett, and Stefano B. Longo. 2018. “Land-Sea Ecological Rifts.” *Monthly Review* 70 (3): 106–121.
- Clausen, Rebecca, and Brett Clark. 2005. “The Metabolic Rift and Marine Ecology.” *Organization & Environment* 18 (4): 422–444.
- Clow, Michael and D. McLauchlin. 2007. “Healing the Metabolic Rift Between Farming and the Ecosystem.” *Socialist Studies/Études Socialistes* 5–25, Spring.
- Coulthard, Glen Sean. 2014. *Red Skin, White Masks*. Minneapolis: University of Minnesota Press.
- Cox, Oliver Cromwell. 1964. *Capitalism as a System*. New York: Monthly Review Press.
- Dickens, Peter. 2014. *Nature and Society*. Cambridge: Polity.
- Du Bois, W.E.B. 1992. *Black Reconstruction in America*. New York: Atheneum.
- Dunbar-Ortiz, Roxanne. 2014. *An Indigenous Peoples’ History of the United States*. Boston: Beacon Press.
- Empson, Martin. 2013. *Land and Labour*. London: Bookmarks.
- Engels, Frederick. 1978. *Socialism: Utopian and Scientific*. New York: International Publishers.

- Estes, Nick. 2019. *Our History Is the Future*. London: Verso.
- Federici, Silvia. 2004. *Caliban and the Witch*. Brooklyn, NY: Autonomedia.
- Flaherty, Eoin. 2013. "Geographies of Communitarity, Colonialism, and Capitalism." *Historical Geography* 41: 39–79.
- Flaherty, Eoin. 2019. *Complexity and Resilience in the Social and Ecological Sciences*. London: Palgrave Macmillan.
- Foster, John Bellamy. 2000. *Marx's Ecology*. New York: Monthly Review Press.
- Foster, John Bellamy. 2013. "Marx and the Rift in the Universal Metabolism of Nature." *Monthly Review* 65 (7): 1–19.
- Foster, John Bellamy. 2015. "The Great Capitalist Climacteric." *Monthly Review* 67 (6): 1–18.
- Foster, John Bellamy. 2019. "On Fire This Time." *Monthly Review* 71 (6): 1–17.
- Foster, John Bellamy. 2020. *The Return of Nature*. New York: Monthly Review Press.
- Foster, John Bellamy, and Paul Burkett. 2016. *Marx and the Earth*. Leiden: Brill.
- Foster, John Bellamy, and Paul Burkett. 2018. "Value Isn't Everything." *Monthly Review* 70 (6): 1–17.
- Foster, John Bellamy, and Brett Clark. 2020. *The Robbery of Nature*. New York: Monthly Review Press.
- Foster, John Bellamy, Brett Clark, and Hannah Holleman. 2020. "Marx and the Indigenous." *Monthly Review* 71 (9): 1–19.
- Foster, John Bellamy, Brett Clark, and Hannah Holleman. 2021 [forthcoming]. "Marx and the Commons." *Social Research: An International Quarterly*.
- Foster, John Bellamy, Brett Clark, and Richard York. 2010. *The Ecological Rift*. New York: Monthly Review Press.
- Foster, John Bellamy, Hannah Holleman, and Brett Clark. 2020. "Marx and Slavery." *Monthly Review* 72 (3): 96–117.
- Fraser, Nancy. 2014. "Behind Marx's Hidden Abode." *New Left Review* 86: 55–72.
- Fraser, Nancy. 2016. "Expropriation and Exploitation in Racialized Capitalism." *Critical Historical Studies* 3 (1): 163–178.
- Friedman, Michael. 2018. "Metabolic Rift and the Human Microbiome." *Monthly Review* 70 (3): 70–105.
- Fromm, Erich. 1970. *The Crisis of Psychoanalysis*. Greenwich, CT: Fawcett.
- Gunderson, Ryan. 2011. "The Metabolic Rifts of Livestock Production." *Organization & Environment* 24 (4): 404–422.
- Hamilton, Clive, and Jacques Grinevald. 2015. "Was the Anthropocene Anticipated?" *The Anthropocene Review* 2 (1): 59–72.
- Holleman, Hannah. 2018. *Dust Bowls of Empire*. New Haven, CT: Yale University Press.
- Klein, Naomi. 2014. *This Changes Everything*. New York: Simon & Schuster.
- Lefebvre, Henri. 2016. *Marxist Thought and the City*. Minneapolis: University of Minnesota.
- Liebig, Justus von. 1859. *Letters on Modern Agriculture*. London: Walton and Maberly.
- Liebig, Justus von. 1862. "Introduction." In *Agricultural Chemistry*, translated by Lady Gilbert, seventh ed. Hertfordshire: Archives at Rothamsted Research.
- Liebig, Justus von. 1863. *The Natural Laws of Husbandry*. New York: Appleton.
- Liebig, Justus von. 2018. "1862 Preface to *Agricultural Chemistry*." *Monthly Review* 70 (3): 146–150.
- Linebaugh, Peter. 2008. *The Magna Carta Manifesto*. Berkeley: University of California Press.
- Longo, Stefano B. 2012. "Mediterranean Rift." *Critical Sociology* 38 (3): 417–436.
- Longo, Stefano B., and Brett Clark. 2016. "An Ocean of Troubles." *Social Problems* 63 (4): 463–479.
- Longo, Stefano B., Rebecca Clausen, and Brett Clark. 2014. "Capitalism and the Commodification of Salmon." *Monthly Review* 66 (7): 35–55.
- Longo, Stefano B., Rebecca Clausen, and Brett Clark. 2015. *The Tragedy of the Commodity*. New Brunswick, NJ: Rutgers University Press.
- Lukács, Georg. 2003. *A Defence of 'History and Class Consciousness': Totalitarianism and the Dialectic*. London: Verso.
- Magdoff, Fred. 2011. "Ecological Civilization." *Monthly Review* 62 (8): 1–25.
- Malm, Andreas. 2016. *Fossil Capital*. London: Verso.
- Malm, Andreas. 2018. *The Progress of This Storm*. New York: Verso.
- Mancus, Phillip. 2007. "Nitrogen Fertilizer Dependency and its Contradictions." *Rural Sociology* 72 (2): 269–288.
- Måråld, Erland. 2002. "Everything Circulates." *Environment and History* 8: 65–84.
- Marcuse, Herbert. 1978. *The Aesthetic Dimension*. Boston: Beacon.
- Marx, Karl. 1970. *A Contribution to the Critique of Political Economy*. Moscow: Progress Publishers.

- Marx, Karl. 1973. *Grundrisse*. London: Penguin Books.
- Marx, Karl. 1974a. *Early Writings*. London: Penguin Books.
- Marx, Karl. 1974b. *The Ethnological Notebooks*. Assen, Netherlands: Van Gorcum and Co.
- Marx, Karl. 1975a. "Excerpts from M.M. Kovalevskii (Kovalevsky)." In *The Asiatic Mode of Production*, edited by Lawrence Krader, 343–412. Assen, Netherlands: Van Gorcum.
- Marx, Karl. 1975b. *Texts on Method*. Oxford: Blackwell.
- Marx, Karl. 1976. *Capital*. Vol. 1. London: Penguin Books.
- Marx, Karl. 1981. *Capital*. Vol. 3. London: Penguin Books.
- Marx, Karl. 1983. "Marx-Zasulich Correspondence: Letters and Draft." In *Late Marx and the Russian Road*, edited by Teodor Shanin, 97–26. New York: Monthly Review Press.
- Marx, Karl, and Frederick Engels. 1975. *Collected Works*. New York: International Publishers.
- Mészáros, István. 1995. *Beyond Capital*. New York: Monthly Review Press.
- Morton, John Chalmers. 1859. "On the Forces Used in Agriculture." *Journal of the Society of Arts* 53–68, 9 December.
- Napoletano, Brian M., Brett Clark, John Bellamy Foster, and Pedro S. Urquijo. 2020. "Sustainability and Metabolic Revolution in the Works of Henri Lefebvre." *World* 1 (3): 300–317.
- Napoletano, Brian M., Jaime Paneque-Gálvez, Yadira Méndez-Lemus, and Antonio Vieyra. 2019. "Geographical Rift in the Urban Periphery, and Its Concrete Manifestations in Morelia, Mexico." *Journal of Latin American Geography* 18 (1): 38–64.
- Napoletano, Brian M., Jaime Paneque-Gálvez, and Antonio Vieyra. 2015. "Spatial Fix and Metabolic Rift as Conceptual Tools in Land-Change Science." *Capitalism Nature Socialism* 26 (4): 198–214.
- Napoletano, Brian M., Pedro S. Urquijo, Jaime Paneque-Gálvez, Brett Clark, Richard York, Iván Franch-Pardo, Yadira Méndez-Lemus, and Antonio Vieyra. 2018. "Has (Even Marxist) Political Ecology Really Transcended Metabolic Rift?" *Geoforum* 92: 92–95.
- Rockström, Johan, Will Steffen, Kevin Noone, Åsa Persson, F. Stuart Chapin, III, Eric F. Lambin, Timothy M. Lenton, Marten Scheffer, Carl Folke, Hans Joachim Schellnhuber, Björn Nykvist, Cynthia A. de Wit, Terry Hughes, Sander van der Leeuw, Henning Rodhe, Sverker Sörlin, Peter K. Snyder, Robert Constanza, Uno Svedin, Malin Falkenmark, Louise Karlberg, Robert W. Corell, Victoria J. Fabry, James Hansen, Brian Walker, Diana Liverman, Katherine Richardson, Paul Crutzen, and Jonathan A. Foley. 2009. "A Safe Operating Space for Humanity." *Nature* 461 (24): 472–475.
- Saito, Kohei. 2014. "The Emergence of Marx's Critique of Modern Agriculture: Ecological Insights from His Excerpt Notebooks." *Monthly Review* 66 (5): 25–46.
- Saito, Kohei. 2017. *Karl Marx's Ecosocialism*. New York: Monthly Review Press.
- Salleh, Ariel. 2010. "From Metabolic Rift to 'Metabolic Value'." *Organization & Environment* 23 (2): 205–219.
- Slater, Eamonn. 2018a. "Engels on Ireland's Dialectics of Nature." *Capitalism Nature Socialism* 29 (4): 31–50.
- Slater, Eamonn. 2018b. "Marx on the Colonization of Irish Soil." MUSSI Working Paper Series, <http://mural.maynoothuniversity.ie/9342/1/ES-Marx-2018.pdf> (accessed 12 March 2021).
- Slater, Eamonn, and Terrence McDonough. 2008. "Marx on Nineteenth-Century Colonial Ireland." *Irish Historical Studies* 36 (142): 153–172.
- Steffen, Will, Katherine Richardson, Johan Rockström, Sarah E. Cornell, Ingo Fetzer, Elena M. Bennett, Reinette Biggs, Stephen R. Carpenter, Wim de Vries, Cynthia A. de Wit, Carl Folke, Dieter Gerten, Jens Heinke, Georgina M. Mace, Linn M. Persson, Veerabhadran Ramanathan, Belinda Reyers, and Sverker Sörlin. 2015. "Planetary Boundaries." *Science* 347 (6223): 1259855.
- Thompson, Edward P. 1982. *Beyond the Cold War*. New York: Pantheon.
- Wallace, Rob. 2016. *Big Farms Make Flu*. New York: Monthly Review Press.
- Wallace, Rob. 2020. *Dead Epidemiologists*. New York: Monthly Review Press.
- Wallace, Rob, Alex Liebman, Luis Fernando Chaves, and Rodrick Wallace. 2020. "COVID-19 and Circuits of Capital." *Monthly Review* 72 (1): 1–15.
- Weis, Tony. 2007. *The Global Food Economy*. New York: Zed Books.
- Weston, Del. 2014. *The Political Economy of Global Warming*. New York: Routledge.