

## CHAPTER 2

# Value in the Web of Life

Every civilization must decide what is valuable. The Marxist tradition makes occasional reference to a “law of value”—but this “law” can scarcely be detected in most radical analyses of capitalism, its historical movements, and its relation to the web of life. Greens, even Marxist Greens, tend to avoid the question of value in some ways, but embrace it in others. Indeed, the spirit of the “law of value” is fundamental to the Green critique, which asks: How do we view nature, in part or as a whole, as valuable? What are the ethics of a sustainable civilization? How are the valuations of nature practiced—through markets, states, and ideas—in the modern world? What I wish to suggest is the possibility for a productive synthesis of Marxist and Green thinking along these lines. I pursue this synthesis by asking: How does a reading of Marx’s law of value through the *oikeios* help us understand the development, crises, and restructurings of capitalism, from its origins to the present?

Civilizations are shaped and defined by their priorities: by deciding what things and what relations are valuable. Their rules of reproducing power and wealth turn on these choices of what is—and what is not—valuable. For capitalism, the choice has been clear, and peculiar. “Value” is determined by labor productivity in commodity production: the average labor-time embedded in the average commodity. This kind of value was unprecedented, and its expressions were spectacular. For feudalism, and “tributary” civilizations in general, wealth turned on land productivity. Never before had any civilization negotiated the transition from land productivity to labor productivity as the metric of wealth. The difference is between how many bushels of wheat, or rice, or maize can be grown in the average worker-hour, and how many bushels can be grown on a hectare (or furlong, or *mu*) of land.

Of course, such contrasts are about more than who produces what, and from where and to whom the surplus flows. “Laws” of value speak also to dominant ethico-political judgments about what is valuable. A capitalist looks at a forest and sees dollar signs; an environmentalist sees trees and birds and soils; a world-ecologist sees how humans and other species have co-produced the forest, and how that “bundled” forest simultaneously conditions and constrains capital today. As we shall see in [Chapter Ten](#), the entwining of these ethico-political valuations with capitalism’s Cheap Nature strategy has reached a new phase in the early twenty-first century. Their contradictions are generating not only a movement towards a more violent, more toxic, and more oppressive form of capitalism, but also powerful countermovements. These movements are today not only challenging, but offering alternatives to, capitalism’s law of value.

### VALUE RELATIONS IN THE CAPITALIST WORLD-ECOLOGY: AN OUTLINE

Just what is that law of value? First, let us be clear that we get “law” as a term from Marx, who got it from Hegel. *Law*, in this sense, is not an iron law of determination, but rather a law in the “Hegelian sense of the ‘abstract’.”<sup>1</sup> To speak of a *law* of value, then, is not to engage history in a prison house of structural abstraction, but to advance a working proposition about a durable pattern of power and production that has obtained over the time and space of historical capitalism. To pick up on one of Marx’s favored metaphors, the law of value acts as a kind of gravitational field, shaping broad patterns, yet allowing significant contingency.

Second, one of the enduring legacies of Cartesian dualism is a privileging of substances over relations in thinking about value. This is true for Marxists as well as Greens. Value is abstract social labor, say the Marxists, and it is determined by socially necessary labor-time: the average labor-time embodied in the average commodity. “But wait!” says the Green thinker. “The average labor-time is just one part of what makes that commodity possible.”<sup>2</sup> The Marxist law of value forgets that Nature—with a capital ‘N’—contributes to the value of all the products that humans use. To which the Marxist, quite properly, says that the whole basis of Marx’s political economy is the distinction between “wealth” and “value.”<sup>3</sup> And there, the discussion seems to have stopped. It replays an older discussion with feminist scholars, who, like the Greens, rightly challenged the blindness of Marxists to the foundational contributions of another kind of invisible work: the daily and intergenerational reproduction of human life. Such work, as we know, is overwhelmingly performed by women.<sup>4</sup>

Can we ford this great divide? Between Green and feminist insights into the centrality of unpaid work/energy for capital accumulation, and the Marxist view that labor productivity is the decisive metric of wealth and competitive fitness under capitalism?

I think we can. And I think the way forward looks something like this. The substance of value *is* socially necessary labor-time. The drive to advance labor productivity *is* fundamental to competitive fitness. This means that the exploitation of commodified labor-power is central to capital accumulation, and to the survival of individual capitalists. But this cannot be the end of the story. For the relations necessary to accumulate abstract social labor are—*necessarily*—more expansive, in scale, scope, speed, and intensity. Capital must not only ceaselessly accumulate and revolutionize commodity production; it must ceaselessly search for, and find ways to produce, Cheap Natures: a rising stream of low-cost food, labor-power, energy, and raw materials to the factory gates (or office doors, or ...). These are the Four Cheaps. The law of value in capitalism is a law of Cheap Nature.

What this law says, in effect, is that that every great wave of accumulation turns on Cheap Nature, understood as use-values produced with a below-average value-composition. In systemic terms, Cheap Nature is produced when the interlocking agencies of capital, science, and empire—blunt categories, yes—succeed in releasing new sources of free or low-cost human and extra-human natures for capital. The Four Cheaps are at the core of such Cheap Natures, reproduced cyclically across the history of capitalism. “Cheap Nature” is punctuated here—with an emphatically uppercase “C” and “N”—because we are focusing on capitalism’s way of seeing the world. The bourgeois vision supposes that the web of life can be fragmented, that its moments can be valued through calculations of price and value.

Cheap Nature is “cheap” in a historically specific sense, defined by the periodic, and radical, reduction in the socially necessary labor-time of these Big Four inputs: food, labor-power, energy, and raw materials.<sup>5</sup> Cheap Nature, as an accumulation strategy, works by reducing the value composition—but increasing the technical composition—of capital as a whole; by opening new opportunities for the investment; and, in its qualitative dimension, by allowing technologies and new kinds of nature to transform extant structures of capital accumulation and world power. In all this, *commodity frontiers*—frontiers of appropriation—are central. Thus, the tightly connective movements of “internal” restructuring and geographical expansion that restore and reconfigure the Four Cheaps. The great expansions of the long nineteenth and twentieth centuries, for instance turned on cheap coal and oil, cheap metals, cheap food, alongside the massive destabilization of peasant societies from eastern Europe to East Asia.

But, and here is the key point: the movements creating the necessary relations and conditions of Cheap Nature cannot be reduced to the immediate processes of production, or even commodity production and exchange as a whole. These are crucial and indispensable.

But they are not sufficient. For capitalism depends on a repertoire of strategies for *appropriating* the unpaid work/energy of humans and the rest of nature outside the commodity system. These strategies cannot be reduced to so-called economic relations but are enabled by a mix of science, power, and culture. I know these are blunt instruments, but they will suffice. The reality is interpenetrated, messy, and complex. Crucially, science, power, and culture operate within value's gravitational field, *and are co-constitutive of it*.

The implication is explosive: the law of value represents a determination of socially necessary labor-time, which occurs simultaneously through organizational and technical innovation *and* through strategies of appropriating the unpaid work/energy of “women, nature, and colonies.”<sup>6</sup> Absent massive streams of unpaid work/energy from the rest of nature—including that delivered by women—the costs of production would rise, and accumulation would slow. Every act of exploitation (of commodified labor-power) therefore depends on an even greater act of appropriation (of unpaid work/energy). Wage-workers are exploited; everyone else, human and extra-human, is appropriated. And lest the reader think I am letting capitalism off the hook, let me rephrase an old Marxist joke: The only thing worse than being exploited is ... *being appropriated*. The history of capitalism flows through islands of commodity production, developing within oceans of unpaid work/energy. These movements of appropriation produce the necessary conditions for the endless accumulation of capital (value-in-motion).

In other words: Value does not work unless most *work* is not valued.

The law of value under capitalism is, then, comprised of two moments. One is the endless accumulation of capital as abstract social labor. The other, the ceaseless expansion of the relations of exploitation and appropriation, joined as an organic whole. This perspective stresses the historical and logical *non-identity* between the value-form and its necessarily more expansive value-relations. While Marxist political economy has taken value to be an *economic* phenomenon with systemic implications, the inverse formulation may be more plausible: value-relations are a *systemic* phenomenon with a pivotal economic moment. Far from denying the centrality of socially necessary labor-time to capitalist civilization, such an approach affirms Marx's greatest contribution within a theoretical frame implicit in the dialectical method. Thinking of value as a systemic phenomenon with a pivotal economic moment allows us to connect the production and accumulation of surplus value with its necessary conditions of reproduction. It recognizes, moreover, that these conditions extend beyond the circuit of capital: the accumulation of abstract social labor is possible through the appropriation of unpaid work (human and extra-human). The value-form (the commodity) and its substance (abstract social labor) depend upon value-relations that configure wage-labor with its necessarily more expansive conditions of reproduction: unpaid work. Importantly, capital's appropriation of unpaid work transcends the Cartesian divide, encompassing both human and extra-human work outside, but necessary to, the circuit of capital and the production of value.

#### VALUE AS METHOD: CAPITAL, CLASS, AND NATURE

The law of value is not only a law of Cheap Nature but a terrain of class struggle. As I have argued elsewhere, the rise of capitalism and the formation of a peculiar law of value over the long sixteenth century was a process of class struggle; the great frontier expansions, encompassing both the “global Baltic” and the global Atlantic, were in part motivated by the strength of the western European peasantry in beating back feudal restoration. This value regime emerged only as class struggles blocked feudal restoration in west-central Europe and propelled the expansion of commodity production and exchange overseas. Where and when value-relations reached into the European heartland, the class struggle quickly reached a

boiling point. This was the case in the Central European mining and metallurgy boom and the ensuing German Peasants' War (1525), only the most dramatic of a series of class struggles involving workers and peasants against capital and the state.<sup>7</sup>

Value, then, cannot be regarded a discrete empirical process alongside that of class struggle and class formation—no more than value-relations can be understood as social process independent of the web of life. There is no recipe that can deliver us from either abstract structuralism or abstract voluntarism; the only guide that I have found useful is to hold in one's analytical hands the active tension between the logic of capital and the history of capitalism, between the apparently "social" and the seemingly "environmental." Only then can we think through and with "the muddle of messy living and dying" in human history.<sup>8</sup>

My approach is to take the emergent contradictions of the accumulation process as the point of departure for a larger project: unifying the history of capitals, natures, and class struggles as mutually relational movements in the modern world-system. Just as social reductionism and environmental determinism represent twin perils, so do abstract generalism and abstract particularism.<sup>9</sup> My alternative takes capitalism's value-relations as a point of entry, a means of opening new questions about power, re/production, and nature in the modern world. It is undeniable that the contradictions of capital do not tell the whole story of historical change in the modern world. But all is not happenstance; there *are* patterns, and these patterns cohere—and diverge—through definite relations of power and production. These relations are guided, shaped, influenced—and over time increasingly so—by the law of value.

My argument emerges from three observations.

First, the law of value, established through capital's ruthless drive to commodify and to appropriate the web of life, establishes the durable "stakes of the game."<sup>10</sup> These have been struggled over since the sixteenth century. Just as the history of class struggle in the feudal era emerges in and through the contest over the rate of seigniorial levy,<sup>11</sup> so the struggles of capitalism unfold through the contest over the rate of surplus value. I do not mean to suggest that this is the end of the story; but it is hard to begin the story without reference to these stakes.

Second, value as world-historical project presupposes something false: that all of nature can be reduced to an interchangeable part. Such falsification powerfully effects the very real, if partial, transformation of nature into simplified spaces, such as cash-crop monocultures. Perhaps most significantly, the emergence and development of the law of value as historical-material movement is inconceivable without the symbolic and scientific revolutions that "discovered" the homogeneity of time and space in early modern Europe. Progressively consolidated as the metric of wealth in the modern world—after 1450 there would be no systemic reversals of commodification—the value form enabled all manner of "metrical revolutions" outside the immediate circuit of capital,<sup>12</sup> but clearly homologous to value's simplifying thrust. Foucault's biopolitical "power of regularization"<sup>13</sup> is unimaginable except in a symbolic-material world orbiting around value's fantasies of homogenizable time and space. Indeed, successive revolutions in the "measure of reality"<sup>14</sup> have been the necessary precondition for subsequent movements of widening and deepening the capitalization and appropriation of all life.

Finally, a historically grounded approach to value allows us to resolve an interpretive problem. On the one hand, advocates of a relational ontology of capitalism-in-nature have been reluctant to move towards an interpretation of capitalism as world-historical and world-ecological process.<sup>15</sup> Environmental historians, on the other hand, are (quite reasonably) focused on landscape change, energy consumption, pollution, and so forth, but have been wary to move from "environment" to *oikeios* and back again.<sup>16</sup> A world-historical recuperation of value theory offers a fruitful way forward without abandoning the insights of

either camp. With Marx, I will move from the analysis of what makes capital to what capital makes, from the logic of capital to the history of capitalism.

Why Marx's value theory? Is this not an anti-ecological formulation that explicitly denies nature's contribution to capitalist development? I don't think so, for two big reasons. First, value is a historically specific form of wealth—whose “original sources” are land and labor.<sup>17</sup> Marx's conception of value, *already*, entwines human and extra-human work and their constitutive relations. Second, the historical specificity of value-relations encompasses not only wage-work but also the mobilization of uncaptialized natures—soils, women's work, peasant re/production, and so forth—as a fundamental to the rate of exploitation. Nevertheless, value in capitalism remains peculiar and arbitrary—but historically patterned. Assigning value-creation to labor-power within commodity production, the pattern compelled ceaseless geographical expansion and restructuring. This occurred, necessarily, not only to expand the reserve army of labor, but to entrain ever-wider spheres of uncaptialized nature in service to advancing labor productivity.

If “land productivity” enjoyed primacy in pre-capitalist civilizations, “labor productivity” became the metric of wealth in the capitalist era. It is a simple, and simplifying, logic. More and more extra-human nature attaches to every quantum of socially necessary labor-time. Fewer people produce more: more calories, more shoes, more cars, more *stuff*.

This labor productivity metric—a rough and ready shorthand for Marx's law of value—has and has not been central to Green critique since the 1970s. This is most evident in the critique of industrial agriculture's colossal energy- and nutritional-inefficiency.<sup>18</sup> Capital-intensive agriculture has become more, not less, central to rising energy consumption in the Global North since the 1970s, contributing a stunning “80 percent of energy flow increases” in the U.S. between 1997 and 2002.<sup>19</sup> The flip side of such profligate energy consumption was a more than eightfold increase in the labor productivity of advanced capitalist agriculture between 1945 and the mid-1980s.<sup>20</sup> What the more or less conventional Green critique is unable to explain is how this colossal inefficiency is not merely an output of the system, but constitutive of it. For this peculiar valuation of wealth as abstract social labor—labor productivity—favors socio-ecological developments that reward the rapid exhaustion of nature (including human nature), so long as external supplies can be secured.

#### A PECULIAR WAY OF ORGANIZING NATURE

Modernity's law of value is an exceedingly peculiar way of organizing life. Born amid the rise of capitalism after 1450, the law of value enabled an unprecedented historical transition: from land productivity to labor productivity as the metric of wealth and power. It was an ingenious civilizational strategy, for it enabled the deployment of capitalist *technics*—crystallizations of tools and ideas, power and nature—to appropriate the wealth of uncommodified nature in service to advancing labor productivity. The great leap forward in the scale, scope, and speed of landscape and biological transformations in the three centuries after 1450 may be understood in this light, as we see in [Chapter Seven](#).

We can glimpse the emergence of this peculiar valuation from the earliest moments of the transition to capitalism. From the sixteenth century, the law of value began to take shape out of the global extensions of commodity production and exchange, stretching from the silver mines of Saxony and Potosí to the sugar plantations of Brazil and Barbados, and the timber frontiers of Scandinavia and the Baltic. This was early capitalism's commodity frontier strategy, and it was central to an epochal shift because it raised labor productivity by treating uncaptialized nature as a substitute for machinery. At every turn, land (forests, silver veins, fertile soils) was organized by empires, planters, seigneurs, yeoman farmers, and others as a force of production in servitude to the commodity form—as a mechanism for advancing the

productivity of labor. Treating the whole of uncapitalized nature as a force of production, early capitalism was able to remake planetary natures in epochal fashion.<sup>21</sup>

Long before capitalism came around, civilizations had been remaking natures on a large scale: feudal Europe, the Greek city-states, the Romans, successive Chinese empires, the Sumerians, and many others. In every instance, there were vital clusters of commercial activity and commodity production and of course huge imperial projects: the Great Wall, the Pyramids. What changed after 1450 were the relevant units, and organization, of time and space. Pre-modern civilizations transformed regions over the span of centuries. Capitalism transformed regional landscapes in mere decades. Through the capacities of monetary capital to command, and indeed to produce, space, there emerged a fundamentally globalizing mode of producing wealth, nature, and power, centered on the commodity form. As central to its era as railroads or automobiles were to theirs, sugar production moved rapidly across the Atlantic world after 1450, from Madeira to São Tomé, enclosing in successive turns Pernambuco, Bahia, Barbados, and from there, the wider Caribbean. Silver mining flowered in central Europe, moving restlessly from one site to another. It then relocated through the alchemies of empire and finance to Potosí, half a world away, only to give way in turn to the great silver mines of Zacatecas and Guanajuato in the eighteenth century. Commodity frontiers premised on forest products, on fish, on iron and copper, on cereals and flax, moved with the same socio-spatial rhythm (not in lockstep, but as a dance), occupying, producing, and exhausting the ecological formations of the North Atlantic, from the shores of Newfoundland to southern Norway, the banks of the Vistula and the foothills of the Urals.<sup>22</sup> In contrast to the view of early capitalism as technologically or socially inert, every movement of global occupation and transformation signaled a new phase of social organization, technical deployment, and landscape discipline. Never before had any world-ecological regime moved so fast, so far. Something decisive had changed.

To call that “something” Nature/Society would merely restate the problem we seek to answer. But if we can accept, even provisionally, that Marx’s value theory identifies a “deep structure” of historical capitalism, we have a clue to how human and extra-human nature work is entwined. This weave of the human and extra-human—a “law” of value—gives priority to labor productivity, and mobilizes uncapitalized natures without regard for their reproduction. Here we have more than a simple restatement of the problem. We have the possibility of understanding capitalism as premised on a fundamental disequilibrium in the (value) relation of capitalization and appropriation in the web of life. If we, moreover, follow Marx and identify the external vent (the frontier) as central—recall how he moves in successive chapters at the end of *Capital* from the “conquest” of the national “home market” to the “commercial wars ... which [have] the globe as its battlefield,” to the “growth of the international character of the capitalist regime” and its mounting systemic contradictions<sup>23</sup>—then we may begin to see the successive resolutions of the disequilibrating tendency as essentially self-limiting. To explore this self-limiting movement, one must move from the logic of capital to the history of capitalism.

This analytic possibility is vitally important because it will help to answer the greatest question of our times: What are the limits to capitalist civilization, and how are these limits constituted by humans and the rest of nature? It would be mystifying to say that the limits of capitalism are ultimately determined by the biosphere itself, although in an abstract sense this is true. This is a view of Nature as an independent system. Yet, this view is insufficient for understanding *how* capitalism reaches limits, *how* capitalism has transcended limits historically, and *how* capitalism has remade successive historical natures in a way that may pose intractable problems for its survival today. How do we pose, and try to answer productively, the “how” of capitalism-in-nature?

Marx's conception of value seems to offer a useful way to answer these questions. It allows us to discern not merely the patterns of power, re/reproduction, and accumulation over the *longue durée*, but the logic animating these patterns' emergence and evolution. I call this method *eductive* because we are locating value as a gravitational field. The patterns that take shape through this field move at once in quasi-linear and contingent fashion. In all this, money is of course of very important, and not just to capitalist civilization. What money *represents*, however, is not nearly so obvious. Money is so important in historical capitalism because it is central to three interconnected processes: 1) the carving out of a part of human activity, paid work, and giving it special value; 2) the de-valuing of the rest of nature, so as to put these natures to work for free, or low cost; 3) governing the evolving boundary between capitalization and appropriation, between "economy," its constitutive relations, and the web of life. For monetary accumulation ("into which all commodities dissolve themselves") at once imprints and registers the material transformation of commodity production (where money "dissolves itself into all commodities").<sup>24</sup> Recognizing capital accumulation as both objective process and subjective project, Marx's value thinking offers a promising way to comprehend the inner connections between accumulation, biophysical change, and modernity as a whole.

#### VALUE AND THE CENTRALITY OF SOCIALLY NECESSARY UNPAID WORK

These inner connections could be glimpsed from the origins of modernity. They underpinned the epoch-making transformations of land and labor in early modern capitalism (see [Chapter Seven](#), "Anthropocene or Capitalocene?"). These transformations were not, however, the straightforward result of capital in its economic expression. This strange metric—value—oriented the whole of west-central Europe towards an equally strange conquest of space. The geographical movements of commodification and appropriation were mutually determined by a symbolic-material reworking of space through value. Marx calls this strange reworking the "annihilation of space by time."<sup>25</sup> Across the long sixteenth century we can see a new form of time—abstract time—emerging. While all civilizations in some sense are built to expand across varied topographies, none represented these topographies as external and progressively abstracted in the ways that dominated early capitalism's geographical praxis. The genius of capitalism's Cheap Nature strategy was to represent time as linear, space as flat, and nature as external.<sup>26</sup> It was a civilizational inflection of the "God-trick,"<sup>27</sup> with bourgeois knowledge representing its special brand of quantifying; and scientific reason as a mirror of the world—the same world then being reshaped by early modernity's scientific revolutions in alliance with empires and capitals. The God-trick was producer and product of abstract social nature: the co-production of Nature as something to be mapped, rationalized, quantified, and above all, *controlled* in ways that eased the endless accumulation of capital.

With abstract time, in other words, comes abstract space.<sup>28</sup> They were the indispensable corollaries to the weird crystallization of nature as abstract social labor. It was this ascendant law of value—operating as gravitational field rather than mechanism—that underpinned the extraordinary landscape and biological revolutions of early modernity. In these centuries we find the origins of capitalism's Cheap Nature strategy, the very strategy that underpins today's biospheric turbulence. This strategy enables advancing labor productivity in great bursts by means of effecting even greater bursts in the production of the Four Cheaps: labor-power, food, energy, and raw materials. The catch is that capital-labor relations are not well-equipped to map, code, survey, quantify and otherwise identify and facilitate *new* sources of Cheap Nature. This latter has involved all manner of knowledge-practices, closely linked but not reducible to territorial power, in which the expanded reproduction of the capital-*unpaid*

work relation has been central. This is the terrain of abstract social nature and accumulation by appropriation.

The idea of nature as external has worked so effectively because the condition for capital's "self"-expansion is the location and production of natures external to capital. (A palpably co-productive process.) Because these natures are historical and therefore finite, the exhaustion of one historical nature quickly prompts the "discovery" of new natures that deliver qualitatively new and quantitatively larger sources of unpaid work. Thus did the Kew Gardens of British hegemony yield to the International Agricultural Research Centers of American hegemony, which in turn were superseded by the bioprospecting, rent-seeking, and genomic mapping practices of the neoliberal era.<sup>29</sup>

But the origins of Nature go back to the sixteenth century. Early capitalism's world-praxis, fusing symbolic coding and material inscription, moved forward an audacious fetishization of nature, crystallized in the era's cartographic, scientific, and quantifying revolutions. These were the symbolic moments of primitive accumulation, creating a new intellectual system whose presumption, personified by Descartes, was the separation of humans from the rest of nature.

The origins of Cheap Nature are, of course, more than intellectual and symbolic. The transgression of medieval intellectual frontiers was paired with the transgression of medieval territoriality. While civilizational expansion is in some sense fundamental to all, there emerged in early modern Europe a specific geographical thrust. While all civilizations had frontiers of a sort, capitalism did something very different. Before the sixteenth century, civilizational frontiers—such as feudal Europe's drive east of the Elbe—were more-or-less an output of the system. With the rise of capitalism, frontier-making was much more fundamental: not merely a safety valve, but a constitutive spatial moment unlocking the epoch-making potential of endless accumulation. The extension of capitalist power to new, uncommodified spaces became the lifeblood of capitalism. I have elsewhere considered the historical geographies of early capitalism's commodity frontiers.<sup>30</sup> For the moment, I wish to highlight two relational axes of these frontiers. First, commodity frontier movements were not merely about the extension of commodity relations, although this was central. They were also, crucially, about the deployment of territorial power and geographical knowledges necessary for the commodity-oriented appropriation of unpaid work/energy. This unpaid work could be delivered by humans—women or slaves, for example—or by extra-human natures, such as forests, soils, or rivers. Second, from the very beginning such frontiers were essential to creating forms of Cheap Nature specific to capitalism.

What are the implications of this line of thought for a post-Cartesian historical method, one that takes the law of value as a co-production of humans bundled with the rest of nature?

For Marx, use- and exchange-value represent "on the surface" the "internal opposition of use-value and value."<sup>31</sup> Marx's discussion in these opening pages of *Capital* is pitched at so high a level of abstraction that the significance of this "internal opposition" has been insufficiently grasped. To say that value and use-value are *internally related* is to say that the value relation encompasses the relation value/use-value in a way that necessarily extends beyond the immediate process of production. Here is a connection that allows us to join definite "modes of production" and definite "modes of life" in concrete historical unities.<sup>32</sup>

This means that capitalism can be comprehended through the shifting configuration of the exploitation of labor-power and the appropriation of Cheap Nature. This dialectic of paid and unpaid work demands a disproportionate expansion of the latter (appropriation) in relation to the former (exploitation). The reality is suggested by those widely cited estimates on the contribution of unpaid work performed by humans<sup>33</sup> and the rest of nature ("ecosystem services").<sup>34</sup> The quantitative reckonings for unpaid human work—overwhelmingly delivered by women—vary between 70 and 80 percent of world GDP; for "ecosystem services,"

between 70 and 250 percent of GDP. The relations between these two moments are rarely grasped,<sup>35</sup> and their role in long waves of accumulation rarely discussed.<sup>36</sup> Importantly, unpaid work comprises more than ongoing contributions to the daily reproduction of labor-power and the production cycles of agriculture and forestry. It also encompasses the appropriation of *accumulated* unpaid work, in the form of children raised to adulthood largely outside the commodity system (e.g., in peasant formations) and subsequently pushed or pulled into wage-work; and in the form of fossil fuels produced through biogeological processes.

The appropriation of unpaid work signifies something beyond the important—but still too partial—notation of environmental costs and externalities as “missing” from the determination of value.<sup>37</sup> For capitalism is not merely a system of unpaid costs (“externalities”). It is a system of unpaid work (“invisibilities”). Here we may borrow a core insight from feminist Marxism: the contribution of unpaid work is not “just there,” but actively produced through complex (yet patterned) relations of power, (re)production, and accumulation. I risk pedantry here in saying that the “free gifts” of nature are not “low-hanging fruit” that can simply be picked without much time or effort. Cheap Natures are actively produced. All life is actively, creatively, incessantly engaged in environment-making—such that, in the modern world, human ingenuity (such as it is) and human activity (such as it has been) must *activate* the work of particular natures in order to appropriate particular streams of unpaid work. Such activation is co-produced, bundling the life-activities of human and extra-human nature, in the present and accumulated over time.

What are the implications for a historically grounded theory of value? On the one hand, capitalism lives and dies on the expanded reproduction of capital: value-in-motion. The substance of value is abstract social labor, or socially necessary labor-time. On the other hand, this production of value is particular—it does not value everything, only labor-power in the circuit of capital—and therefore rests upon a series of devaluations. Plenty of work—the majority of work in the orbit of capitalism—does not register as valuable. Work by humans, especially women; but also “work” performed by extra-human natures. Quite reasonably, Hribal asks, “Are animals part of the working class?”<sup>38</sup> The question itself illuminates the law of value’s absurd, yet consistent, praxis. Although confusion persists on the matter, it is now clear that Marx understood that extra-human natures perform all sorts of useful (but not specifically *valuable*) work for capitalist production, and that such useful work was *immanent* to the capital-relation.<sup>39</sup> Marx’s reading of value was, in other words, eminently post-Cartesian.

All of these de- and un-valued forms of work are, however, outside the value form (the commodity). They do not directly produce value. And yet—it is a very big *and yet*—value as abstract labor cannot be produced except through unpaid work/energy. This leads me to an unavoidable conclusion: the value *form* and the value *relation* are non-identical. The “commodification of everything” can only be sustained through incessant revolutionizing—yes, of the forces of production, but also of the *relations of reproduction*. The relations of reproduction cut across the paid/unpaid work and human/extra-human boundaries. In this, the historical condition for socially necessary labor-time is socially necessary unpaid work.

De-valued work becomes an “immanent ... antithesis” within the generalization of commodity production and exchange.<sup>40</sup> In this contradiction, between the expanded reproduction of capital and the reproduction of life, we have “two universes, two ways of life foreign to each other yet whose wholes explain one another.”<sup>41</sup> And what is the geographical implication of this enabling and constraining tension between paid and unpaid work? The necessity of frontier-making. Recurrent waves of socio-ecological exhaustion—understood as the inability of a given bundle of human/extra-human natures to deliver more work to capital—motivate recurrent waves of geographical expansion. The commodity frontier strategy has been epoch-making not because of the extension of commodity production and

exchange as such—a common misunderstanding of commodity frontier theory.<sup>42</sup> Rather, commodity frontiers were so epoch-making because they extended the zone of appropriation *faster* than the zone of commodification. Marx puts his finger on the crucial dialectic when he addresses the contradictions of the working day, the tendency towards manifold “industrial patholog[ies],” and the necessity of incorporating “physically uncorrupted” human natures into the world proletariat (see [Chapter Nine](#)).<sup>43</sup>

It will consequently not suffice to identify the influence of abstract social labor as an “economic” phenomenon, although this remains pivotal. The endless frontier strategy of historical capitalism is premised on a vision of the world as interminable: this is the conceit of capital and its theology of limitless substitutability.<sup>44</sup> At best, substitutability occurs within definite limits, primarily those of energy flows and the geographical flexibility they offer. The history of capitalism is one of relentless flexibility rather than endless substitutability. The conditions through which successive world-ecological revolutions have been realized—each yielding a quantum leap in the mass of “physical bodies” and making new streams of unpaid work/energy available for commodity production—may be understood as a succession of one-off affairs. Capitalism has moved from peat and charcoal to coal to oil; from the breadbaskets of the Vistula, southern England, and the American Midwest; to labor frontiers in Europe and Africa, Latin America, and South and East Asia. These are not repeatable events. Substitutability does not unfold through infinite time and space.

Abstract social labor, in this reading, is the *economic expression* of the law of value. That law is unworkable historically without strategies of appropriating Cheap Nature. Why? Because the creation of socially necessary labor-time is constituted through a shifting balance of human and extra-human work. Socially necessary labor-time, in other words, is co-produced. If climate change suppresses agricultural productivity, as it has been doing for some time now,<sup>45</sup> the value-composition of production shifts accordingly—and not only in agriculture. Socially necessary labor-time forms and re-forms in and through the web of life.<sup>46</sup> Early capitalism’s landscape transformations, in their epoch-making totality, were unthinkable without new ways of mapping space, controlling time, and cataloging external nature—and they are inexplicable solely in terms of world-market or class-structural change. The law of value, far from reducible to abstract social labor, finds its necessary conditions of self-expansion through the creation and subsequent appropriation of Cheap Natures. These movements of appropriation must, if capital is to forestall the rising costs of production, be secured through extra-economic procedures and processes.

By this I mean something more than the recurrent waves of primitive accumulation that we have come to accept as a cyclical phenomenon of capitalism.<sup>47</sup> These also remain crucial. But between our now cherished dialectic of “expanded reproduction” and “accumulation by dispossession”<sup>48</sup> are those knowledges and associated practices committed to the mapping, quantifying, and rationalizing natures in service to capital accumulation. Thus the trinity: abstract social labor, abstract social nature, primitive accumulation. This is the relational core of capitalist world-praxis. And the work of this unholy trinity? Produce Cheap Natures. Extend the zone of appropriation. In sum, deliver labor, food, energy, and raw materials—the Four Cheaps—faster than the accumulating mass of surplus capital derived from the exploitation of labor-power. Why? Because the rate of exploitation of labor-power (within the commodity system) tends to exhaust the life-making capacities that enter into the immediate production of value:

Capital asks no questions about the length of life of labor-power. What interests it is purely and simply the maximum of labour-power that can be set in motion in a working day. It attains this objective by shortening the life of labour-power, *in the same way* as a greedy farmer snatches more produce from the soil by robbing it of its fertility.<sup>49</sup>

Exhaustion might take the form of an obvious withering of “vital forces.”<sup>50</sup> More often, however, exhaustion manifests in the inability of a given production complex to yield a rising stream of unpaid work—performed by human and extra-human natures alike. This latter form of exhaustion typically issues from some combination of class struggle, biophysical change, and the tendentially rising “geographical inertia” of regional built environments.<sup>51</sup> In a world treated as boundless, capital as a whole has evinced a cumulative, but cyclically punctuated, tendency to search out and appropriate new, “physically uncorrupted” zones of Cheap labor, food, energy, and raw materials. Exhaustion signals a rising value composition of capital, and the inflection point of decline for a given production complex to supply more and more unpaid work to regional accumulation.<sup>52</sup> To the degree that “foreign preserves” can be identified and dominated, the relative “degeneration of the industrial population” matters little.<sup>53</sup> Has it been so different for extra-human natures? English agriculture, though not necessarily physically depleted, was certainly exhausted in terms of its capacity to send a rising stream of Cheap Food to metropolitan capital by the early decades of the nineteenth century.<sup>54</sup> Not surprisingly, British capitalism at its mid-century apex would nourish itself on the basis of cheap calories—grain and sugar—supplied from New World frontier zones in North America and the Caribbean.<sup>55</sup>

We can now connect the dots between the rise of capitalism and the emergence of the law of value. Value relations incorporate a double movement to exploitation and appropriation. Within the commodity system, the exploitation of labor-power reigns supreme. But this supremacy is only possible, given its tendency towards self-exhaustion, to the degree that the appropriation of uncommodified natures counteracts this tendency. This has been difficult to discern because value *relations* are necessarily much broader than the immediate production of commodities. The generalization of commodity production has proceeded through an expansionary web of value relations whose scope and scale extends well beyond production. The problem of capitalist development is one of the uneven globalization of wage-work *dialectically joined to* the “generalization of its conditions of reproduction.”<sup>56</sup> The centrality of wage-work in certain Marxist perspectives is not wrong but partial, given the unsustainability of the circuit of capital as closed system. The difficulty in pursuing this alternative analysis has been rooted in the dualisms immanent to modern thought; for to construct capitalism in the fashion that I have suggested is to transcend the man/woman, nature/society boundaries upon which the whole edifice of modernist thought depends.<sup>57</sup> Not only do we need to unify the distinctive but mutually formative dialectics of human work under capitalism through the nexus paid/unpaid work—“productive” and “reproductive” work. We also need to recognize that capitalism’s dynamism has owed everything to appropriating and co-producing ever more creative configurations of human and extra-human work across the *longue durée*.

If we take the nexus of paid/unpaid work as our premise, capitalism and value relations cannot be reduced to a relation between the owners of capital and the possessors of labor-power. *The historical condition of socially necessary labor-time is socially necessary unpaid work.* This observation opens a vista on capitalism as a contradictory unity of production and reproduction that crosses the Cartesian boundary. The meaningful distinction is between the zone of paid work (the exploitation of commodified labor-power) and the zone of unpaid work (the reproduction of life). This contradictory unity works by creating a relatively narrow sphere of commodity production within which labor-power can be said to yield either rising or falling productivity, represented (imperfectly) through input-output calculations. This narrow sphere, premised on the exploitation of labor-power within commodity production, operates in relation to a much more expansive sphere of appropriation, through which the diversity of nature’s “free gifts”—including the reproduction of life from the family to the biosphere—may be taken up into commodity production, but not fully capitalized. Why not?

Because the capitalization of reproduction is subject to the exhaustive tendencies we have just discussed, which imply a rising value composition of capital and signal a situation in which capital must bear a greater share of its own costs.

This new law of value, turning on socially necessary labor-time within commodity production, required an expansive (*and expanding*) domain of appropriating cheap natures. Early capitalism excelled at this: developing technologies and knowledges unusually well-suited to identifying, coding, and rationalizing Cheap Natures. Here the new way of seeing the world—inaugurated by the emergence of Renaissance perspective—decisively conditioned a new organizing *technics* for the capitalist world-ecology, manifesting in the cartographic-shipbuilding revolution of early modernity, from the Portolan maps and caravels to Mercator globes and galleons, and much beyond.

Appropriating cheap natures was and is a far more creative act than the *dependencia* language of plunder allows.<sup>58</sup> “Appropriation” represents a productive activity every bit as much as “exploitation.” The outright seizure of basic wealth—clearly not an invention of the sixteenth century—could not provide a durable basis for the endless accumulation of capital. But the new praxis of Cheap Nature did. Here appropriative practices combined with the world market and technological innovations oriented towards global expansion. These practices comprised quite conscious colonial strategies to reorganize indigenous populations into strategic hamlets that functioned as labor reserves: the *reducciones* in the Andes and the *aldeias* in Brazil during the sixteenth century.<sup>59</sup> The practices enabled a rising rate of surplus value by treating the land, *simultaneously*, as a force of production and a “free gift.” It did not matter that horrific levels of mortality accompanied this rising labor productivity so long as the costs of appropriation—through indigenous and African slave trades—were sufficiently low.<sup>60</sup>

This speaks to a problem not only of economic historiography but also of Marxist political economy. We are, in the conventional reading of Marx, offered two categories for the production of surplus value: absolute (more hours worked) and relative (more commodities produced in the same number of hours). Marx focused on the basic tendencies at play in the rise of large-scale industry, and this focus has been reproduced ever since. But Marx also points towards a theory of the rate of exploitation that is grounded in the dialectic of human and extra-human natures. In this, soil fertility may “act like an increase of fixed capital.”<sup>61</sup> We can take this reference to soil fertility as a shorthand for the life-making capacities of human and extra-human natures. Even where extraordinary soil fertility was in some sense “given,” it was equally co-produced: as in the fertility of seventeenth-century Bahia or the nineteenth-century American Midwest and Great Plains. Absent the cartographic-shipbuilding revolution of the long sixteenth century, or the railroad revolution and the rationalization of American territory in the long nineteenth century, the bounty of these frontiers was no more than *potential*. These “hard” and “soft” technologies of production advanced labor productivity by harnessing the capacities of these natures to work for free. But it took work to get these natures to work for free. *This* was the innovation of early capitalist technical advance. Sugar and wheat frontiers remade the world only through extraordinary movements of capital, knowledge, and humans, each movement a mighty expenditure of energy aimed at transforming nature’s *work* into the bourgeoisie’s *value*. Yes, coal and oil are dramatic examples of this process of appropriating unpaid work. But this observation—namely, that fossil fuels have been central to rising labor productivity—is turned into a fetish when the same processes are not applied to early capitalism.

The consequence is a massive blind spot in radical thought: the great labor productivity revolution of early capitalism is almost universally ignored.<sup>62</sup> I suspect this has happened because our metrics and narrative frames have been largely unable to bring unpaid work into value-relations. The challenge is to internalize, in our narrative frames and analytical

strategies, the ways that configurations of paid and unpaid work stabilize, and are cyclically restructured, through successive productivity regimes. Returning to our early modern frame, we might ask how to internalize, analytically, the fertility windfalls of *massapé* soils in seventeenth century Brazil? Or the contributions of the families of the *mitayos* (forced wage-workers) traveling to the Potosí mines? Or those of Norwegian and Baltic forests to the shipbuilding centers of the Dutch Republic? Or peasant cultivation to the off-season iron-making work of Swedish peasants, whose labor costs were correspondingly much lower than their English competitors? And perhaps most spectacularly—I am again transgressing the Cartesian boundary—the work of African families whose sons and daughters were impressed into slavery?

This early modern labor productivity revolution turned not only on Smithian specialization, technological change, and organizational innovation, but also on the new *technics* of value through which cheap natures were mapped, organized, and appropriated. The “fertility” of Cheap Natures was the pedestal for productivity advance within the commodity zone. Perhaps inadvertently, Clark offers an illuminating contrast about labor productivity informed by a caloric metric. In a passage that would resonate with any energy-centered critic of industrial agriculture, Clark notes that the average “worker-hour” in English agriculture around 1800 yielded about 2,600 calories, premised on wheat, milk, and wheat staples.<sup>63</sup> In contrast, the average “worker-hour” in swidden agriculture in early nineteenth century Brazil, cultivating manioc, maize, and sweet potatoes, yielded anywhere between 7,000 and 17,600 calories.<sup>64</sup>

What does this tell us? Most of all, it tells us that early capitalism triumphed because of its ability to appropriate the astounding realities, and realize the extraordinary potentialities, of uncommodified natures worldwide. If sixteenth-century Europe was exceptional in any technological sense, it was in this domain. Food works well as an example, because the metrics are easy, but one could multiply the appropriations of worker-hour windfalls to all sectors of early capitalism. How would work-hour productivity in timber vary between, say, coppiced English forests and the relatively unmanaged Norwegian forests of the late sixteenth century? Or between long-exploited Central European silver mines and Potosí’s Cerro Rico around 1550? These differences were not “produced” in any straightforward, linear sense. But neither were these bountiful frontiers simply there for the taking. *They were co-produced.*

There was necessarily a mix of serendipity and strategy at play in early capitalism’s productivity revolution: serendipity, insofar as New World crops such as maize, potatoes, and manioc were high-yielding; and strategy, insofar as the new commodity frontiers (sugar and silver especially) actively constructed production systems around such high-yielding crops. But even where Old World crops were introduced—the Spaniards in colonial Peru loved wheat—the initial yields were extraordinarily high (an order of magnitude greater than the Europe average) and remained so for the first long wave of colonial domination (c.1545–1640).<sup>65</sup> The point can scarcely be overstated: the introduction of “Cheap” food, as civilizational strategy, “acts like an increase in fixed capital.” The declining price (value composition) of food equals advancing labor productivity equals the rising rate of exploitation.

The catch? The cheapening of food—along with raw materials and energy—cannot be accomplished by economic and territorial means alone. Cheap Food, and Cheap Nature as capitalist project, could be realized only through the symbolic regimes of abstract social nature. These encompassed the “primitive accumulation of botanical knowledge” organized by Iberian botanical gardens,<sup>66</sup> the emergence of a new “map consciousness,”<sup>67</sup> the “death of nature” inaugurated by early modern materialism,<sup>68</sup> and much more. We will have both motive and opportunity to return to the question of abstract social nature later in this book.

The law of value-in-formation during early capitalism—*and since*—unfolded through two simultaneous movements, corresponding to the dialectic of value/use-value. The latter is “produced” through the zone of appropriation—the condition for *value*—encompassing the unpaid work/energy of human and extra-human natures. Historical capitalism has been able to resolve its recurrent crises because territorialist and capitalist agencies have extended the zone of appropriation faster than the zone of exploitation. This has allowed capitalism to successively overcome seemingly insuperable “natural limits” through the coercively enforced and scientifically enabled restoration of the Four Cheaps: labor-power, food, energy, and raw materials. The Four Cheaps are produced by effecting “accumulation by appropriation” faster than “accumulation by capitalization.” This is possible on a planet where capitalization is limited and most life reproduces without the help of capital: the reality of early but not twenty-first-century capitalism. Hence, the centrality of the frontier and imperialism in capital accumulation. Significant enlargements in the zone of appropriation resolve capitalism’s crises by simultaneously reducing the value composition of production, expanding physical output, and opening new spheres of capital investment. All of that can proceed so long as capitalization is checked, and appropriation liberated. This is, indeed, the history of capital, empire, and science in the modern world: every new era of capitalism brings with it a new industrialization, a new imperialism, a new science.

## CONCLUSION

Taking value as an educative method acknowledges the increasing centrality of value relations in the modern world-system over the past five centuries. Value emerges in and through Braudel’s “market economy,”<sup>69</sup> weaving together the ethereal valences of finance capital and the prosaic routines of everyday life in new world-historical crystallizations of power and profit, pivoting on the commodity. In this light, the apparently external relations of capitalism to nature are revealed as inner relations (capitalism-in-nature), constitutive of new, and profoundly restless, socio-ecological configurations.

Having opened the possibility for a view of value-in-nature, another challenge presents itself: to see value as a way to investigate the singular metabolism of modernity. To this challenge we may now turn.

---

1 P.M. Sweezy, *The Theory of Capitalist Development* (New York: Monthly Review Press, 1970), 19.

2 Cf. S.G. Bunker, “Modes of Extraction, Unequal Exchange, and the Progressive Underdevelopment of an Extreme Periphery,” *American Journal of Sociology* 89, no. 5 (1984): 1017–64.

3 Cf. Burkett, *Marx and Nature* (1999); Foster, *Marx’s Ecology* (2000).

4 L. Vogel, *Marxism and the Oppression of Women* (New Brunswick, NJ: Rutgers University Press, 1983); M. Dalla Costa and S. James. *The Power of Women and the Subversion of the Community* (Bristol, UK: Falling Wall Press, 1972); S. Federici, *Wages against Housework* (Bristol, UK: Falling Wall Press, 1973).

5 Many colleagues have insisted on a “Fifth” Cheap Element: Cheap Money. This is undeniably true. *However*, Cheap Money—whose maintenance is the strategic priority of leading capitalist interests today—works only through its capacity to restore Cheap Nature. Cheap Money serves to re/produce Cheap Nature; it is not Cheap Nature as such. Nevertheless, the constitutive relations between money/capital/nature-as-*oikeios* merit sustained investigation and conceptual elaboration.

6 M. Mies, *Patriarchy and Accumulation on a World Scale* (London: Zed, 1986), 77.

7 Moore, "Nature and the Transition from Feudalism to Capitalism" (2003); "The Modern World-System as Environmental History?" (2003); "Ecology and the Rise of Capitalism" (2007); "'Amsterdam Is Standing on Norway' Part I" and "Part II" (2010).

8 Donna J. Haraway, "Staying with the Trouble: Anthropocene, Capitalocene, Chthulucene," in *Anthropocene or Capitalocene?*, ed. J.W. Moore (Oakland: PM Press, forthcoming).

9 F. Araghi and P. McMichael, "Contextualizing (Post)modernity" (Paper presented to the Annual Meeting of the American Sociological Association, 2004).

10 P. Bourdieu and L. Wacquant, *An Invitation to Reflexive Sociology* (Chicago: University of Chicago Press, 1992), 177.

11 G. Bois, "Against the Neo-Malthusian Orthodoxy," *Past and Present* 79 (1978); 60–9.

12 W. Kula, *Measures and Men* (Princeton: Princeton University Press, 1986).

13 M. Foucault, *Society Must Be Defended* (New York: Picador, 2003).

14 A.W. Crosby, *The Measure of Reality* (Cambridge: Cambridge University Press, 1997).

15 Cf. Smith, *Uneven Development* (1984); Braun and Castree, eds., *Remaking Reality* (1998); Peet et al., *Global Political Ecology* (2011).

16 Pivots of discussion in environmental history include W. Cronon, *Changes in the Land* (New York: W.W. Norton, 1983); idem., *Nature's Metropolis* (New York: W.W. Norton, 1991); idem., *Uncommon Ground*, New York: W.W. Norton, 1996); Crosby, *The Columbian Exchange* (1972); idem., *Ecological Imperialism* (Cambridge: Cambridge University Press, 1986); W. Dean, *With Broad Ax and Firebrand* (Berkeley: University of California Press, 1995); M. Gadgil and R. Guha, *This Fissured Land* (Berkeley: University of California Press, 1992); R.H. Grove, *Green Imperialism* (Cambridge: Cambridge University Press, 1995); J.R. McNeill, *Something New Under the Sun* (New York: W.W. Norton, 2000); Merchant, *Death of Nature* (1980); idem. *Ecological Revolutions* (Chapel Hill: University of North Carolina Press, 1989); R. White, *Organic Machine* (1995); D. Worster, *Rivers of Empire* (Oxford: Oxford University Press, 1985).

17 Marx, *Capital*, Vol. I (1977), 638.

18 M. Perelman, *Farming for Profit in a Hungry World* (Montclair, NJ: Allanheld, Osmun & Co., 1977); D. Pimentel, et al., "Food Production and the Energy Crisis," *Science* 182 (1973): 443–9.

19 P. Canning, et al., "Energy Use in the U.S. Food System" (Economic Research Report Number 94, Washington: United States Department of Agriculture, 2010), 1.

20 P. Bairoch, "Les Trois Révolutions Agricoles du Monde Développé," *Annales: É.S.C.* 44, no. 2 (1989): 317–53.

21 Moore, "Ecology and the Rise of Capitalism"; "'Amsterdam Is Standing on Norway' Part I" and "Part II" (2010).

22 Moore, "'Amsterdam Is Standing on Norway' Part I" and "Part II" (2010).

23 Marx, *Capital*, Vol. I (1977), 913, 915, 929.

24 Marx, *Grundrisse* (1973), 142.

25 Ibid., 424.

26 L. Mumford, *Technics and Civilization* (London: Routledge and Kegan Paul, 1934); C. Merchant, *The Death of Nature* (1980); J. Pickles, *A History of Spaces* (New York: Routledge, 2004).

27 D. Haraway, "Situated Knowledges," *Feminist Studies* 14, no. 3 (1988): 575–599.

28 Lefebvre, *The Production of Space* (1991).

29 L.H. Brockway, *Science and Colonial Expansion* (New York: Academic Press, 1978); J. R. Kloppenburg, Jr., *First the Seed* (Cambridge: Cambridge University Press, 1988); K. McAfee, "Neoliberalism on the Molecular Scale," *Geoforum* 34, no. 2 (2003): 203–219.

30 Moore, "Sugar and the Expansion of the Early Modern World-Economy," *Review* 23, no. 3. (2000); "Nature and the Transition from Feudalism to Capitalism"; "The Modern World-System as Environmental History?" (2003); "Madeira, Sugar, and the Conquest of Nature in the 'First' Sixteenth Century, Part I"; "'Amsterdam Is Standing on Norway' Part I" and "Part II"; "Madeira, Sugar, and the Conquest of Nature in the 'First' Sixteenth Century, Part II" (2010).

31 Marx, *Capital*, Vol. I (1977), 153, 209.

32 Marx and Engels, *The German Ideology* (1970), 42.

33 UNDP [United Nations Development Programme], *Human Development Report 1995* (Oxford: Oxford University Press, 1995); M. Safri and J. Graham, "The Global Household," *Signs* 36, no. 1 (2010): 16.

- 34 R. Costanza, et al., “The Value of the World’s Ecosystem Services and Natural Capital,” (1997); “Changes in the Global Value of Ecosystem Services,” *Global Environmental Change* 26 (2014): 152–8.
- 35 But cf. P. Perkins, “Feminist Ecological Economics and Sustainability,” *Journal of Bioeconomics* 9 (2007): 227–44.
- 36 On unpaid human work, cf. P.A. O’Hara, “Household Labor, the Family, and Macroeconomic Instability in the United States: 1940s-1990s,” *Review of Social Economy* 53, no. 1 (1995): 89–120.
- 37 Cf. R. Patel, *The Value of Nothing* (New York: Picador, 2009).
- 38 J. Hribal, “Animals are Part of the Working Class: A Challenge to Labor History,” *Labor History* 44, no. 4 (2003): 435–54.
- 39 Burkett, *Marx and Nature* (1999).
- 40 Marx, *Capital*, Vol. I (1977), 209.
- 41 F. Braudel, *Afterthoughts on Material Civilization and Capitalism* (Baltimore: Johns Hopkins University Press, 1977), 6.
- 42 Moore, “Sugar and the Expansion of the Early Modern World-Economy” (2000): 409–33; “El Auge de la Ecologia-Mundo Capitalista, I,” *Laberinto* 38 (2013): 9–26. “El Auge de la Ecologia-Mundo Capitalista, II,” *Laberinto* 39 (2013), 6–14.
- 43 Marx, *Capital*, Vol. I (1977), 380.
- 44 Much of ecological economics can be read as a sustained critique of this theology. A useful introduction is found in H.E. Daly and J. Farley, *Ecological Economics* (Washington, D.C.: Island Press, 2004); also M. Perelman, “Scarcity and Environmental Disaster” (2007).
- 45 D.B. Lobell, et al., “Climate Trends and Global Crop Production since 1980,” *Science* 333, no. 6042 (2011): 616–620.
- 46 “[T]he process of reproduction has to be considered from the standpoint of the replacement of the individual components of C’both in value and in material.” (Marx, *Capital*, Vol. II [1978], 469).
- 47 M. de Angelis, *The Beginning of History* (London: Pluto, 2007).
- 48 D. Harvey, *The New Imperialism* (Oxford: Oxford University Press, 2003).
- 49 Marx, *Capital*, Vol. I (1977), 376. Emphasis added.
- 50 *Ibid.*, 380.
- 51 From D. Harvey, *The Limits to Capital* (London: Verso, 1982), 428–9.
- 52 This explains something of the recurrent waves of financialization that redounded to the benefit of the declining world hegemon—in their respective *belle époques*, the Dutch, British, and American hegemonies each enjoyed a renewal of accumulation by capitalists in their respective geographical loci by deploying financial means to secure the fruits of agro-industrial expansions, based on new appropriations of cheap nature elsewhere in the world (Arrighi, *The Long Twentieth Century* [1994]).
- 53 J. Cairnes, *The Slave Power* (London: Parker, Son and Bourn, 1862), quoted in Marx, *Capital*, Vol. I, 377.
- 54 Thomas, *The Industrial Revolution and the Atlantic Economy* (1993).
- 55 Cronon, *Nature’s Metropolis* (1991); Mintz, *Sweetness and Power* (New York: Penguin, 1985).
- 56 P. McMichael, “Slavery in Capitalism,” *Theory and Society*, 20, no. 3 (1991): 343.
- 57 V. Plumwood, *Feminism and the Mastery of Nature* (New York: Routledge, 1993), 41–68; M. Waring, *If Women Counted* (San Francisco: Harper and Row, 1988).
- 58 Cf. B. Clark and J.B. Foster. “Ecological Imperialism and the Global Metabolic Rift,” *International Journal of Comparative Sociology* 50, nos. 3–4 (2009): 311–34.
- 59 D.W. Gade and M. Escobar. “Village Settlement and the Colonial Legacy in Southern Peru,” *Geographical Review* 72, no. 4 (1982): 430–49; S.B. Schwartz, “Indian Labor and New World Plantations,” *American Historical Review* 83, no. 1 (1978): 43–79.
- 60 S.B. Schwartz, *Sugar Plantations in the Formation of Brazilian Society* (Cambridge: Cambridge University Press, 1985); Moore, “Ecology and the Rise of Capitalism” (2007).
- 61 Marx, *Capital*, Vol. I (1977), 238, 636–8; *Grundrisse*, 748.
- 62 This revolution is largely unacknowledged, although sometimes hinted at (cf. D. Landes, *The Wealth and Poverty of Nations* [New York: W.W. Norton, 1998]).
- 63 G. Clark, *Farewell to Alms* (Princeton: Princeton University Press, 2007), 67–8.

64 Ibid.

65 J.C. Super, *Food, Conquest, and Colonization in Sixteenth-Century Spanish America* (Albuquerque: University of New Mexico Press, 1988); J.W. Moore, ““This Lofty Mountain of Silver Could Conquer the Whole World,”” *Journal of Philosophical Economics* 4, no. 1 (2010): 58–103.

66 J. Cañizares-Esguerra, “Iberian Science in the Renaissance,” *Perspectives on Science* 12, no. 1 (2004): 86–124.

67 Pickles, *A History of Spaces* (2004).

68 Merchant, *The Death of Nature* (1980).

69 F. Braudel, *The Wheels of Commerce*, trans. Siân Reynolds (New York: Harper & Row, 1982).

---

## Towards a Singular Metabolism: From Dualism to Dialectics in the Capitalist World-Ecology

*Dialectics does not consider fixed artifacts, formations and objects, the entire complex of both the material world of things and that of ideas ... to be something original and autonomous. It does not accept them in their ready-made form, but subjects them to investigation in which the reified forms of the objective and the ideal worlds dissolve, [and] lose their fixed and natural character. (Kosík, 1976)*

Metabolism is a seductive metaphor. As critical environmental studies across the humanities and social sciences boomed over the past decade, metabolism and its cognates—above all, the “metabolic rift”—has enjoyed a special place in Green and Red-Green thought. Mainstream and radical metabolism arguments have highlighted the importance of a historical perspective on the linkage of global capitalism (or industrial society) and global environmental change.<sup>1</sup> We can say two things about this special place. On the one hand, Marx’s conception of social metabolism has been re-interpreted as the “metabolism of nature and society.”<sup>2</sup> On the other hand, there has been virtually no critical interrogation of social metabolism as the metabolic exchange between two entities: “nature” and “society.” Social metabolism has been cleansed of its double internality.

Why should this be a problem?

Metabolism-centered studies face an unresolved contradiction: between a philosophical-discursive embrace of a relational ontology (humanity-*in*-nature) and a practical-analytical acceptance of the Nature/Society dualism (humanity *and* nature). Indeed, the rise of metabolism as a “conceptual star” in the late 1990s owed much to its promise of fording the Nature/Society divide.<sup>3</sup> At the time—and still today—metabolism promised a way of bringing nature, as *oikeios*, into the core of how we see and think about historical change.

But it has not delivered on that promise. Rather than ford the Cartesian divide, metabolism approaches have reinforced it. Marx’s “interdependent process of social metabolism” became the “metabolism of nature *and* society.”<sup>4</sup> Metabolism as “rift” became a metaphor of separation, premised on material flows *between* Nature and Society. Thus did metabolic *rift* triumph over metabolic *shift* as a means of unifying humanity-*in*-nature within unified metabolisms of power, wealth, and nature. Meanwhile, our Red-Green “conceptual star” resisted the tendency of dialectical praxis to dissolve its analytical objects (Nature/Society), and to create new categories suitable to comprehending the messiness and interpenetration of humans with the rest of nature.

One of Cartesian dualism’s essential features is the tendency to circumscribe truth claims by drawing hard and fast lines between what is human and what is “natural.” We might call this an *epistemic rift*.<sup>5</sup> At the core of this epistemic rift is a series of violent abstractions implicated in the creation and reproduction of two separate epistemic domains: “Nature” and “Society.” The abstractions are “violent” because they remove essential relations from each node in the interests of narrative or theoretical coherence.<sup>6</sup> Not for nothing was this symbolic divorce of Nature and Society consolidated in early capitalism. The epistemic rift was an expression—and, through new forms of symbolic praxis, an agent—of the world-shaking material divorce of the direct producers from the means of production.

If metabolism is not an exchange between quasi-independent objects—Nature/Society—but instead a process of life-making within the biosphere and its human-initiated processes, new possibilities emerge. The epistemic rift might be transcended. A singular metabolism of humanity-in-nature might allow us to chart a course beyond dualism.

This is, in a very general sense, an uncontroversial statement. Of course! Does not everyone wish to transcend dualism? The question often meets with widespread affirmation, especially but not only among critical scholars. But the affirmation requires no real action in the absence of a method—what I am calling the double internality—that enables and encourages new analytics as if nature matters. Even today, the spirit of this double internality remains largely outside the methodological frames, theoretical propositions, and narrative strategies of the humanities and social sciences. They remain captive to the logic of human exceptionalism: the curious notion that humanity “alone is not a spatial and temporal web of interspecies dependencies.”<sup>7</sup> In this logic, relations between humans are regarded as ontologically prior to the relations of nature, a meta-theoretical procedure that allows one to speak of modernity as a set of social relations that act upon, rather than develop through, the web of life.

Emphasizing disruption and separation, rather than reconfiguration and unity, the metabolic rift has come to signify “a disruption in the exchange between social systems and natural systems.”<sup>8</sup> Social systems, in this framework, are separate from natural systems. Social systems *disrupt* natural systems. As capitalism develops, the disruption of nature escalates, leading to “planetary crisis.” Catastrophe ensues.

It all makes a certain amount of sense is it *good* sense? Is nature really best considered as external to—and an external limit of—capitalism? Or is capitalism, *and its limits*, co-produced through shifting configurations of human and extra-human nature?

If one begins with the *oikeios* and the double internality, we may reconceptualize metabolism as a flow of power, capital, and material nature characterized by an “unbroken coincidence of our being, our doing, and our knowing.”<sup>9</sup> To recast our narrative on the basis of this “unbroken coincidence” implies a movement from “the” environment as object to environment-making—as we saw in [Chapter One](#). For humanity in the era of historical capitalism, environment-making has reached a stage of development capable of facilitating a new geological era. This is usually called the Anthropocene (“Age of Man”), but is more accurately called the Capitalocene (“Age of Capital”). It is certain that the twenty-first century is a moment of extraordinary global change.

The task of interpreting these extraordinary global changes is daunting, and complicated by more than the facts on the ground. For the epistemic rift between the “economic” and the “environmental” limits our capacity to understand the present conjuncture; it constrains our understanding of how capitalism has created and resolved crises over the *longue durée*. A concept of metabolism that transcends this epistemic rift may, however, liberate us from these constraints. Metabolism may then become more than a way of seeing flows “between.” It can become a way of seeing flows *through*. In what follows, we consider a reconstruction of metabolism as a means to unify modernity’s differentiated flows of capital, power, and life.

#### FROM GREEN ARITHMETIC TO DIALECTICAL REASON

The turbulence of the twenty-first century confounds the old models of historical change. Even when such models recognize environmental change, they are premised on the idea that capitalism develops *upon* Nature—not *through* the web of life. But financialization, global warming, the rise of China, the end of Cheap Food—and much beyond these—cannot be understood in the old terms. They are neither social nor environmental processes, as

conventionally understood. They *are* bundles of human and extra-human nature whose fundamental connections turn on the configuration of power and re/production in the web of life. In this frame, it is not the humanity's separation *from* Nature that matters. It is humanity's place *within* the web of life. Humanity is differentiated and plural; its diversity cohered through capitalism's re-shaping of the *oikeios*. This approach offers something that the well-worn trope of humanity's separation from Nature cannot: the possibility of discerning the conditions of capitalist renewal (if any) and crisis in the twenty-first century. For I think many of us understand intuitively—even if our analytical frames still lag behind—that capitalism is more than an “economic” system, and even more than a social system. Capitalism is a way of organizing nature.

Such a perspective immediately draws our attention towards two great organizing moments. This is the double internality of historical change. On the one hand, capitalism internalizes—however partially—the relations of the biosphere. In the process, the agencies of capital and empire (but not only these) seek to turn the work/energy of the biosphere into capital (abstract social labor). On the other hand, the biosphere internalizes the relations of capital. These are asymmetrical relations, of course; their valences and vectors change over time. In this, the philosophical point shapes the historical observation: capitalism, like all civilizations, is constituted through a double internalization. Hence capitalism-in-nature/nature-in-capitalism. To say human activity of any sort “organizes” nature is to say that human activity is ontologically coincident with, and constituted through, specifically bundled relations with the rest of nature. “Society” is not only a producer of changes in the web of life but also a *product* of it; this is the heart of a co-evolutionary method in which human history is always bundled with the rest of nature.

The production of nature is therefore always the *co-production* of nature—a co-production not of two ontologically independent units (Humanity plus Nature) but of an evolving mosaic of interdependent flows, forces, conditions, and relations. (Humans are surely distinctive in this mosaic, a point to which we will return.) This means that the accumulation of capital and the pursuit of power in the modern world-system do not *have* an ecological dimension. They are, rather, ways of human organization moving, representing, channeling, and reworking a singular metabolism: the web of life. And in the very act of moving, representing, channeling, and reworking, human organization *acquires new properties*, undergoes cumulative and sometimes fundamental change, and brings new contradictions to the fore.

In this, *all* human activity is environment-making. This extends far beyond what I would call earth-moving: urbanization, agricultural expansion, mining, and so forth. Environment-making includes those symbolic, cultural, and scientific processes central to modernity's reworking of the *oikeios*. The “thinking” and the “doing” of environment-making are two moments of a singular process. Ideas of nature are fundamental to earth-moving. Environment-making is, consequently, not limited to earth-moving. It encompasses those epoch-making revolutions in cartography, mathematics, agronomy, economic botany, quantification, and rationalizing endeavors of all kinds—the relations of *abstract social nature*. In this perspective, “capitalism” names those long-run and large-scale patterns of environment-making that encompass *and are necessary to sustain* a project of endless commodification. Earth-moving always works *through* the extra-economic procedures of mapping and quantifying reality, *through* new “measures of reality” (see [Chapter Eight](#)).<sup>10</sup>

By contrast, metabolism arguments have avoided the active role of cultural process and scientific knowledge in the history of capitalism. They have consequently facilitated a kind of materialism that dramatically understates the role of ideas in historical change. This favors explanations of crisis premised on an exogenous breakdown model, in which overpopulation,

resource scarcity, earth-system breakdown, and increasingly global warming, will cause either planetary disaster or the end of civilization as we know it.

The result is a curious state of affairs in thinking capitalism's historical limits, and considering Marx's "ecological" thought in the study of historical change. For much of Left Ecology, "Marxist ecology = society + nature": an arithmetic rather than dialectical procedure. There are social limits, and there are natural limits. But the boundaries between the two units—Nature/Society—are nowhere specified; and the ways in which Social limits make Natural limits, and vice versa, are unexplored. The *history* of each limit is asserted rather than historically constructed.<sup>11</sup> By and large, the metabolism argument has painted a picture of capitalism sending Nature into the abyss ... with little sense of *how* history is co-produced by humans in the web of life. (And does not our politics turn on this "how"?) The consequence is a static and ahistorical theory of natural limits, in which Humans (not-Nature) ultimately push Nature (not-Humans) too far, whereupon nature exacts its "revenge."<sup>12</sup> Too often, however, the revenge of Nature appears as impending cataclysm, and too rarely, as a "normal" cyclical phenomenon of capitalism. This narrow view of limits undermines the consideration of how capitalism has overcome its socio-ecological limits historically, and what might be different today.

The one-size-fits-all model of ecological crisis is a problem if we acknowledge nature as a constitutive field and force in modern world history. This history is replete with instances of capitalism overcoming "natural" limits. Any account of capitalist development unable to come to grips with capitalism's cyclical crises—*developmental crises*—will be unable to frame a theory of capitalism's *cumulative* limits today. Ignoring the "normal" operation of capitalism's world-ecological reorganizations, a dual systems approach to metabolism gives us only one flavor of crisis—the apocalypse.<sup>13</sup> In the absence of a rigorous historical approach to the bundling of human and extra-human natures in the accumulation process, arguments for an *epochal* crisis today will tend to fall back on arithmetic rather than dialectical reason.

This fetishization of natural limits is problematic analytically, because it blinds us to the ways that capitalism unfolds historically through the web of life. Positing two metabolisms, one Social and one Natural, the Marxist metabolism school forgets to answer the really revolutionary question: How are distinctive metabolisms of capital, power, and production *unified*, however unevenly, across the long arc of capitalist history?

Such a question hardly rules out the specification of distinctive metabolisms. But it *does* rule out the *a priori* designation of metabolism as an exchange between the mythic categories Nature/Society. In Foster's pioneering work, metabolism moved from an open question—how can categories of class and capital be reworked in light of biophysical flows?—towards a hardening of distinctions: "the metabolism of nature and society." Through Foster's reading,<sup>14</sup> Marx's ecological insights have been taken up by a significant layer of critical scholarship in highly dualist fashion. There is no denying the contribution of Foster's elaboration of the metabolic rift: in its time, the rift concept opened new questions for critical environmental studies. At the same time, Foster's ambivalent dualism blunted the possibilities for a dialectical synthesis.

Such a synthesis confronted other obstacles as well. The formulation of social metabolism as the metabolism of Nature *and* Society has won such great popularity among social scientists because it leaves untouched the sacred category of Society. In channeling research into the metabolism of Nature *and* Society, the radical metabolism perspective has reduced nature to flows and stocks within and between pre-formed units. This has, in turn, driven a wedge between Marx's historical materialism and Marx's theory of value.

And why should this matter? Because capitalism's metabolism of capital, power, and nature is governed by a logic of value accumulation, which reduces the world to zones of exploitation (surplus-value) and appropriation (of unpaid work). A reading of metabolism

that takes seriously the centrality of value as a logic of re/producing the flow of life helps us to see how capitalism has created and transcended limits. Taking an expanded conception of value-relations, we can better interpret the ways in which the worlds of humanity-in-nature became valued and de-valued over the past five centuries, converting the globe into a vast storehouse of unpaid work/energy. This Cheap Nature strategy has been the basis for advancing labor productivity within the commodity system. Marx's conception of value-relations, in other words, provides a way of seeing the exploitation of labor-power and the appropriation of unpaid work as a singular metabolism of many determinations. The exclusion of value-relations from the historical materialism of nature has the virtue of never specifying how capital works through nature—something sure to enhance the metabolic rift's appeal (for now), but at the cost of a necessary clarity.

#### FROM DUALISM TO DIALECTICS: METABOLIC RIFT TO METABOLIC SHIFT

Adding “the environment” to a laundry list is precisely that: additive, and not synthetic. This “soft” dualism tends to justify social-reductionist analyses of neoliberalism's crisis tendencies. Nature, in the dominant critical approach, does not call for any fundamental rethinking of the patterns of recurrence, evolution, and crisis in historical capitalism. For world-historical scholars too, environmental factors are now widely recognized, but again in additive fashion: “the” environment can now be added to a long list of consequential factors in modern world history. The web of life has been transformed into a variable. It is this Green Arithmetic—“Nature plus Society”—that insulates critical political economy and world-historical studies from a view of modernity as producer and product of the web of life. And it is this arithmetic that leads Foster to conclude in 2002—shaping a decade of metabolic rift analysis—that there is no “feedback mechanism that ... turns environmental destruction into increasing costs for capital itself.”<sup>15</sup>

But what if nature matters as more than consequence, as more than variable? How then do we go about reshaping our methodological premises, conceptual vocabulary, and analytical frames to show capitalism-in-nature at work? Any effective response must pursue a translation of the philosophical claim (humanity-in-nature) into workable analytics for the history of capitalism—including, of course, the history of the present.

For the world-ecology synthesis, the historical task is not one of explaining the separation of humanity and nature. The priority is to specify the historical forms of humanity-in-nature, and therefore nature-in-humanity. Humanity's species-being is located at once inside and outside. Marx's “system of nature” is immediately internalized through our life-activity, which, through embodied thought, simultaneously externalizes our experiences and mental constructs in a never-ending, yet asymmetrical and contingent, circle of life.<sup>16</sup>

A world-ecological method unfolds from the premise of a fundamental unity between human activity and the rest of nature. The historical specificity of human organization derives from its co-produced relation within the web of life. There is no ontological divide between the web of life and civilizations, only distinctive variations and configurations. Civilizations are specific forms of power and re/production, which is to say they are producers and products of specific historical natures. Even when environments are in some abstract sense pre-formed (the distribution of the continents, for example), historical change works through the encounters of humans with those environments. That relation is fundamentally co-productive. A mountain range or an ocean is an environmental, not historical, fact. *Historical* change begins when we move from environmental facts to environment-making, through which humans make environments and vice versa. Here we recognize that humanity's environment-making proceeds through the nexus of production and reproduction, a process in which humanity “can only proceed as nature does herself,” by “chang[ing] the form of the

materials.”<sup>17</sup> Such a mode of analysis gives analytical—not just moral—teeth to radicals’ now-ritualized denunciations of capitalism’s destruction, degradation, and disruption of nature. It allows us to shift to the “reordering of matter” through the *oikeios* in its successive historical-geographical forms.<sup>18</sup> The notion that humans relate to nature from within, in our “physical and mental life ... simply means that nature is linked to itself.”<sup>19</sup> From this perspective, the problem is not metabolic *rift*, but metabolic *shift*.

#### TOWARDS A SINGULAR METABOLISM: GEOGRAPHY, NATURE, AND THE LIMITS TO CAPITAL

The pursuit of such a holistic and relational perspective implies a transition from dualism to dialectics. The virtue of the metabolic rift as a heuristic intervention was to highlight the irreducibly geographical character of human activity, always interdependent within the web of life. Metabolisms are always geographical. Capitalist relations move through, not upon, space—which is to say, through and not upon nature as a whole.

Indeed, a closer reading of Foster’s original formulation of metabolic rift opens the possibility for thinking through a singular metabolism of power, nature, and capital. Foster originally formulated the rift in three registers. First, there is a “rift between human production and its natural conditions.” Second, there is a “material estrangement [alienation] of human beings in capitalist society from the natural conditions of their existence.” And third, this rift finds geographical expression in a new town-country antagonism.<sup>20</sup> Foster took the *rift* in metabolic rift to signify the rechanneling of food and resources produced in agrarian zones into urban-industrial spaces. Although metabolic *rift* today is almost universally understood as a metaphor of separation, the original argument suggested something different: rift as reconfiguration and shift.

In this, Foster broke new ground and assembled the elements of a new synthesis. This new synthesis promised not only a revitalized and reworked historical materialism in line with Marx’s system of thought. It would also actively pursue the renewal of value-relational thinking—the law of value as co-produced by humans and the rest of nature—offered by Burkett’s pioneering *Marx and Nature*, a companion to *Marx’s Ecology*.<sup>21</sup> The potential was tantalizing. The incorporation of an ecologically informed theory of value into historical materialism—the synthesis made possible by reading *Marx’s Ecology* and *Marx and Nature* as a singular argument—would be a “groundbreaking” contribution. Its core insight? A theory of the “alienation of nature and the alienation of human production *as two sides of a single contradiction*.”<sup>22</sup> This would allow us to see the history of capitalism as a world history in which nature matters not merely as consequence, but as constitutive and active in the accumulation of abstract social labor.

Foster’s enduring contribution,<sup>23</sup> then, was to suggest how we might read Marx to join capital, class, and metabolism as an organic whole. From this perspective, all social relations are spatial relations and relations within the web of life. Metabolism becomes a way to discern *shifts* (provisional and specific unifications), not *riffts* (cumulative separation). In these terms, the apparent solidity of town and country, bourgeois and proletarian, and above all Society and Nature, begins to melt. Metabolism, liberated from dualisms, acts as a solvent. For if metabolism as a whole is a flow of flows in which life and matter enter into specific historical-geographical arrangements, we are called to construct a much more supple and historically sensitive family of concepts, unified by a dialectical method that transcends all manner of dualisms—not least, but not only, Nature/Society.

What does this mean for the question of limits? Foster’s insight was to posit capitalism as an open-flow metabolism, one that requires more and more Cheap Nature just to stay in place: not just nature as input (e.g., cheap fertilizer) but also nature as waste frontier (e.g., greenhouse gas emissions). Many of the most powerful implications of metabolic rift

thinking, however, remain fettered by the very dualisms that Foster initially challenged. Not least is an unduly narrow view of accumulation as an “economic” process (it is surely much more than this) and an undue emphasis on the rarely specified “destruction” of nature.<sup>24</sup>

Historical natures *are* subject to broadly entropic processes—the degradation of nature—but these are also reversible within certain limits. Much of this reversibility turns on capitalism’s frontiers of appropriation. Thus the centrality of the “Great Frontier.” Walter Prescott Webb coined the term to describe the great shift in the labor-land ratio that inaugurated the rise of capitalism in the sixteenth century.<sup>25</sup> The Great Frontier was, Webb reminded us, the source of unprecedented “windfall profits.” These windfalls began—but did not end—with the plunder of gold and silver. The opening of the Great Frontier marked the rise of a civilization that had begun to pivot on the cash nexus. But the new frontiers offered much, much more than a one-time windfall: they offered up the possibility of an entire historical epoch based on windfall profits. Webb thought the modern world was the product of a great “boom” of economic prosperity that lasted for four centuries. On closer inspection, thanks to the vertical frontiers of coal and then oil, this Great Boom appears to have lasted until the dawn of the twenty-first century (with signs of exhaustion apparent by the 1970s). Although the specifics of Webb’s analysis have often been superseded in the half-century since he wrote it, the basic argument remains as sound as ever: modernity’s epoch-making reorganizations of labor and land were premised on ruthless conquest and the *ongoing appropriation* of wealth on the frontier.

The frontier of what? Of commodification and global value relations. For central to the great arc of modern world history has been the voracious consumption of, and relentless quest for, Cheap Natures—“cheap” in relation to the accumulation of capital and its curious privileging of wage-work as the only thing worth valuing. A civilizational conceit of this sort could only emerge on the basis of devaluing both human work outside the commodity system—much of it so-called women’s work—and the “work” of extra-human natures.

What this line of thought suggests is that the investigation of capitalism and the “end of cheap nature” has been hobbled by its Cartesian sorting out of the problem. Too often, “nature” remains the stuff of metals and oil and corn, to the exclusion of human natures, and to the exclusion of the constitutive relations between them. So I would recommend that our analyses of capitalism’s metabolism and its limits begin by unifying the processes of “surplus humanity” and the end of cheap energy, food, and raw materials. We can dispense with the notion that something like climate change can be analyzed in its quasi-independent social and natural dimensions. And we can embrace the understanding that, with climate change, financialization, or warfare, we are dealing with bundles of human and extra-human natures. These are varied and bundled “determinations of one essence.”<sup>26</sup> Such an embrace would take “limits talk” as a methodological proposition rather than an empirical claim, setting aside the millenarian language of catastrophe and privileging a more hopeful and historical view of limits and crises. Crises are full of danger, to be sure. But they are also, as the Chinese would remind us, full of opportunity.

The limits suggested by a monist and relational view of metabolism bring into focus the historical agency of extra-human natures as internal to capitalism’s crises. Capitalism as world-ecology defies the convenient and Cartesian notion that capital, power, and production can be placed into their bloodless and disembodied boxes, next to another, bigger but still quite tidy box: Nature. And if we still recognize that the capitalist project creates something called Nature in discrete forms (resources, genes, etc.), a world-ecological view of metabolism reveals this view of compartmentalized natures as a “God-trick”: please *do* pay attention to the Man behind the Curtain.

The promise of a singular metabolism perspective is this. It recognizes that the realities signified by capital, power, and nature cannot be engaged within dualist categories. It

dissolves those categories and opens the possibility for new, more relevant and practical, concepts. Capital and power (and more than this, of course) unfold within the web of life, a totality that is shaped by manifold civilizational projects. These projects are not infinitely contingent. Foster and his colleagues are right about the “what” of capitalism’s coherence. Nevertheless, their dualism—an ontological and epistemic rift—keeps them from seeing how value-relations, which are themselves co-produced, make that coherence. These value-relations create quasi-law-like rules of reproduction that necessarily admit contingency: capitalism’s greatest strength has been its flexibility in mobilizing and recombining parts of nature in the interests of endless accumulation. And because value has been premised on valuing some nature (e.g., wage-labor) and not-valuing most nature (“women, nature, colonies”), it necessitated a powerfully alienating conception of Nature as external.

At the core of the capitalist project, from its sixteenth century origins, was the scientific and symbolic creation of nature in its modern form, as something that could be mapped, abstracted, quantified, and otherwise subjected to linear control. This was external nature; it is what we have come to call Nature, even if many of us no longer believe in a Nature that is independent of the Anthropos. (And is not the Anthropos as violent an abstraction as Nature?) It is easy to talk about the “limits to growth” as if they were imposed by this (external) Nature. But the reality is thornier, more complex—and also more hopeful. The limits of capitalist civilization include biophysical realities, but are not reducible to them. And if the limits of capitalism today are limits of a particular way of organizing nature, we are confronted with the possibility of changing humanity’s relation to nature—which is to say also humanity’s relation to itself. We are frequently warned of the alleged dangers of civilizational “collapse.” But is the “collapse” of capitalism—a civilization that plunges more than a third of its population into malnutrition—really something to be feared? Historical experience suggests not. The Fall of Rome after the fifth century, and the collapse of feudal power in Western Europe in the fourteenth century, ushered in golden ages in living standards for the vast majority.<sup>27</sup> We should be wary of making too much of such parallels. But neither should we ignore them.

I have long thought that the most pessimistic view is one that hopes for the survival of modernity in something like its present form. But this is impossible, because capitalism’s metabolism is inherently an open-flow system that continually exhausts its sources of nourishment. There are limits to how much new work capitalism can squeeze out of new working classes, forests, aquifers, oilfields, coal seams, and everything else. Nature is finite. Capital is premised on the infinite. And both are *historical* in a very specific sense: what worked at one historical juncture will not necessarily work at the next. Thus the centrality of the Great Frontier in the history of capitalism, and the centrality of the end of the last frontiers—Cheap oil in the Middle East, Cheap labor-power in China, Cheap food everywhere—in the present conjuncture. It was this Great Frontier that inaugurated a civilizational metabolism in which most nature, including most humans, was sacrificed in service to the productivity of wage-labor. These frontiers of appropriation were the major way of making others, outside the circuit of capital but within reach of capitalist power, foot the bill for endless accumulation. The great secret and the great accomplishment of capitalist civilization has been to *not* pay its bills. Frontiers made that possible. Their closure is the end of Cheap Nature—and with it, the end of capitalism’s free ride.

---

1 Respectively, the “global metabolism” school of thought of Fischer-Kowalski and her colleagues; and the “metabolic rift” perspective of Foster, Richard York, Brett Clark, and their

students. See M. Fischer-Kowalski, et al., “A Sociometabolic Reading of the Anthropocene,” *The Anthropocene Review* 1, no. 1 (2014): 8–33; Foster et al., *The Ecological Rift* (2010).

2 Foster, *Marx’s Ecology* (2000).

3 M. Fischer-Kowalski, “Society’s Metabolism,” in *The International Handbook of Environmental Sociology*, ed. M.R. Redclift and G. Woodgate (Cheltenham, UK: Edward Elgar, 1997) 119–37.

4 Quotations from, respectively, K. Marx, *Capital*, Vol. III., trans. D. Fernbach (New York: Pelican, 1981), 949; J.B. Foster, *Marx’s Ecology* (2000), chapter five.

5 The term is indebted to Vetter, and Schneider and McMichael. Their independent formulations are, however, distinct from epistemic rift as epistemological dualism. J. Vetter, “Expertise, ‘Epistemic Rift,’ and Environmental Knowledge in Mining and Agriculture in the U.S. Great Plains and Rocky Mountains” (Paper presented to the Annual Meeting of the American Society for Environmental History, March 29, 2012); M. Schneider and P. McMichael, “Deepening, and Repairing, the Metabolic Rift,” *Journal of Peasant Studies* 37, no. 3 (2010): 461–84.

6 Sayer, *The Violence of Abstraction* (1987).

7 Haraway, *When Species Meet* (2008), 11.

8 R. York, “Metabolic Rift,” in *Encyclopedia of the Earth*, ed. C.J. Cleveland, (2010), <http://www.eoearth.org/view/article/154577/>, accessed March 8, 2014.

9 Maturana and Varela, *The Tree of Knowledge* (1987), 250.

10 A.W. Crosby, Jr., *The Measure of Reality* (Cambridge: Cambridge University Press, 1997).

11 For example, Foster, et al., *The Ecological Rift* (2010).

12 Engels, “The Part Played by Labor in the Transition from Ape to Man” (1970).

13 Larry Lohmann, “Fetishisms of Apocalypse,” *Occupied Times*, 30 October (2014).

14 Foster, *Marx’s Ecology* (2000).

15 J.B. Foster, *The Ecological Revolution* (New York: Monthly Review Press, 2009), 206.

16 Marx, *Economic and Philosophical Manuscripts* (2007), 157.

17 Marx, *Capital*, Vol. I (1977) 107.

18 P. Verri, quoted in *ibid.*

19 Marx, *Economic and Philosophical Manuscripts*, 133.

20 Foster, “Marx’s Theory of Metabolic Rift,” (1999), 370, 383–4.

21 Cf. Foster, *Marx’s Ecology* (2000), 282n; Burkett, *Marx and Nature* (1999).

22 Foster, “Marx’s Ecological Value Analysis,” *Monthly Review* 52, no. 4 (2000), emphasis added.

23 Foster, *Marx’s Ecology*.

24 Foster, et al., *The Ecological Rift* (2010); Foster, *The Ecological Revolution* (2009).

25 W.P. Webb, *The Great Frontier* (Austin: University of Texas Press, 1964).

26 Marx, “Critique of Hegel’s Philosophy of Right,” (1843), [www.marxists.org/archive/marx/works/1843/critique-hpr/ch05.htm](http://www.marxists.org/archive/marx/works/1843/critique-hpr/ch05.htm).

27 C. Wickham, *Framing the Middle Ages* (Oxford: Oxford University Press, 2005); Wallerstein, *The Modern World-System I* (1974).

---