

NATURE AS ACCUMULATION STRATEGY

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A commodity, according to the classical political economists, comprises and combines a use value and an exchange value. Value, they recognized, was the product of human labour; for Marx it was measured by socially necessary labour time. Capital, he argued, was 'value in motion', and capital accumulation was the process by which capitalist societies multiplied social value through the exploitation of labour. Capitalism has always employed labour power to invest value in use values harvested from nature, and so what could it mean to suggest, as the title of this paper does, that nature has become an accumulation strategy? It is increasingly evident, I want to argue, that in the past three decades, a new dimension of the capitalist production of nature has considerably transformed the social relationship with the natural world.

'On or about December, 1910', Virginia Woolf once famously commented, 'human nature changed'. At about the same time James Joyce thought he perceived the shattering of space, an insight recycled more than half a century later by Henri Lefebvre who highlighted the birth of cubism (which he dated to Picasso's 1908 painting of *Les Femmes d'Alger*) as the moment of a new 'production of space'. It is now commonplace to think of this period prior to World War I as the crucible of new conceptions of space (and time), embodied not simply in artistic and cultural modernism but in such scientific innovations as relativity theory and quantum mechanics, in unison with shifts in the historical geography of capitalism.¹ Far less common, at least in political discourse, is serious reflection on Woolf's observation which, after all, had to do with human nature rather than space or time. Her claim is traditionally treated as enigmatic, metaphorical, a literary more than a literal claim, which emanated from intense discussions within London's Bloomsbury circle. What after all could it mean that human nature – the paragon of seeming unchangeability – had changed? And yet Woolf was onto something, anticipating however fancifully a very real shift in the social relation with nature – except that it would not really materialize for another

half century. The central proposition explored here is that we are currently living through a period in which the core socio-economic relationship with nature is being dramatically transformed.

CAPITALIZED NATURE – NATURE BANKING

Beginning in the 1980s and 1990s, an extraordinary range of new ‘ecological commodities’ came on line. Ironically, they owe their existence, first and foremost, to the success of the environmental movement in the 1960s and 1970s. Subsequent environmental legislation and regulation, developing quite unevenly across different local and national contexts, sought to limit environmental despoliation at the hands of capital, and in the process – sometimes deliberately, sometimes not – created a certain scarcity of what can be called ‘allowable natural destruction’. This in turn led to the development of entirely new markets in ecological ‘goods’ and (especially) ‘bads’. Whereas the traditional commodification of nature generally involved harvesting use values as raw materials for capitalist production – wood for tables, oil for energy, iron ore for steel, various corns for bread – this new generation of ecological commodities is different. Whether they do or do not become the raw material for future production is incidental to their production. Instead, these commodities are simultaneously excavated (in exchange-value terms) from pre-existing socio-natural relations and as part of their production they are reinserted or remain embedded in socialized nature – the more ‘natural’ the better. Green capitalism may be touted as a means of softening the environmental impacts of the capitalist exploitation of nature, or criticized as simply environmental veneer for sustained exploitation, yet whatever the truth of these propositions the significance of ‘green capitalism’ is far more profound. It has become nothing less than a major strategy for ecological commodification, marketization and financialization which radically intensifies and deepens the penetration of nature by capital.

Consider the example of wetlands. In recognition of the beneficent socio-ecological worth and work of wetland habitats, and the danger of their disappearance in the face of urban, suburban, resource and agricultural development, the state at various scales has implemented laws intended to mitigate the loss of such environments. In the United States in the late 1980s, for example, George W.H. Bush, seeking to differentiate himself from a predecessor whose disdain for environmentalism was legendary (‘when you’ve seen one redwood’, California’s Ronald Reagan famously said, ‘you’ve seen them all’), and intent on becoming ‘the environmental president’, insisted that there would be ‘no net loss of wetlands’. As new environmental legislation increasingly required and embodied the conservation of wetlands, a market in

‘wetland credits’ quickly emerged. This process was defined in federal law as follows:

Wetland restoration, creation, enhancement, and in exceptional cases preservation undertaken expressly for the purposes of compensating for unavoidable wetland losses in advance of development actions when such compensation cannot be achieved at the development site....²

At its simplest, a developer who intends to develop an area of wetland can live up to conservation requirements by purchasing credits either from landowners who agree to sequester commensurate amounts of wetland from any future development, or from companies that make it their business to reconstruct or expand previously degraded wetlands. In the 1990s this inspired a burgeoning ‘wetland mitigation banking’ industry in the US to facilitate, coordinate and manage the creation, exchange and banking of wetland credits.³

In this case the commodity produced is, in the most immediate sense, the restored or conserved wetland, and its worth rests precisely in the fact that it cannot be productively consumed. In Marxist terms, the entire process produces a new economic scarcity, namely of mitigable wetlands, where none existed previously. Surplus value is harvested either from the dead labour dormant in the prior destruction of the site – dead labour that now suddenly finds a new exchange value to which it can attach – or from the work of restoration. More than anything, however, the resulting wetland credits represent a draw on ground rent produced by the new or conserved amenity, a credit with only a momentary symbolic connection to the specific work that gave rise to it. Whatever its physical or ecological characteristics, therefore, the central use value of the restored wetlands is precisely their ability to garner exchange value under the new conditions of created scarcity.

The case of wetlands credits and banking is far from anomalous. If anything it is something of a latecomer in the ecological commodities industry. The idea of pollution credits first surfaced in the 1970s, but only in the 1980s did an early model for these burgeoning ecological commodity markets emerge in the form of ‘debt-for-nature’ swaps. These involved various combinations of NGOs, debt-holding banks and governments, and international agencies such as the IMF and World Bank, as well as debtor governments. Some portion of national debt would be forgiven if debtor nations – almost all from the global south – agreed to preserve various tracts of ‘natural’ land. These were soon superseded in scope and complexity and the model proliferated.

In the US the Clean Air Act of 1990, a revision of the 1972 Act, was a watershed regulatory moment in the capitalization of nature.

Today the best known ecological commodities are probably those produced by carbon sequestration programs. In a declared effort to slow down or minimize global warming, these work in a similar way to wetland credits: to absorb carbon dioxide from the atmosphere, landowners possessing tracts of forest land (generally in poorer tropical countries) are paid not to cut their forests, while major polluters in more industrial parts of the world can purchase these credits as a means to allow them to continue to pollute. Alternatively, corporations which cut their emissions – not just carbon but sulphur dioxide, nitrous oxide, and many other pollutants – by more than the levels prescribed by local, national or international regulations (for example the Kyoto accords) earn credits that can be sold on the market to producers who fail to reach their required emission reductions. In the spring of 2006 carbon credits in Europe were selling on the open market for about 30 euros per ton, although the price volatility of this new commodity quickly took its toll.⁴ Other markets for nature credits have emerged for many ecological commodities: biodiversity credits, fishery credits, air and water pollution credits, rare bird credits, and so forth. In Georgia, International Paper is breeding the endangered red-cockaded woodpecker on land it owns; woodpecker credits have already traded at \$100,000 and International Paper hopes in the future to earn as much as \$250,000 per credit for these.⁵ Nature is increasingly transformed into a biodiversity bank; as Cindi Katz has observed, nature's comprehensive 'conversion to a resource in some global accounting ledger has fundamentally altered its status and temporality'.⁶

Whereas the marketization of nature in this way has been championed as a market-friendly amelioration of environmental destruction, it is also widely understood that its effects are not wholly positive. In so far as the site of mitigation may be kilometres or continents away from the site that benefits, this marketization is more likely to deepen uneven development and intensify poverty. The Costa Rican peasant farmer who gets carbon sequestration credits for not cutting the forest may experience a one-time windfall but no permanent enhancement of the family's standard of living, whereas the US corporate polluter buying credits contributes not only to continued pollution but to an intensified accumulation of capital. A parallel, intensified unevenness occurs when protected reserves are turned over for ecotourism, insofar as the world's rich, whose wealth is premised on 'development', are able to consume supposedly pristine nature so long as that nature remains pristine, undeveloped. Nor is it clear that such credits even work in ecological terms. Biodiversity credits may leave various Amazonian habitats intact, for example

(or they may not), but the intensified poverty of local inhabitants often leads to significant if not accelerated environmental degradation anyway. By the same token, while wetland restoration in North America is regulated, there is no guarantee concerning the quality or even the medium-term result of that restoration, and there is certainly no evidence of overall reduction in wetland loss. If one takes a wider geographical perspective on wetland mitigation, it is tempting to paraphrase Engels's assessment of 'the housing question': the bourgeoisie has no solution to the environmental problem, they simply move it around.⁷

The development of markets in ecological commodities is neither accidental nor simply an unintended consequence of otherwise well-meaning environmental legislation. As Morgan M. Robertson has put it, the marketization and banking of such commodities is crucial 'in creating and stabilizing new areas for capitalist activity...'.⁸ Marketizing nature is precisely the point. A US National Academy of Sciences committee estimates that between 1993 and 2000, more than \$1 billion has been invested in US mitigation permits covering perhaps 24,000 acres.⁹ The industry established its own umbrella association in 1998, the National Mitigation Banking Association, which seeks to 'promote federal legislation and regulatory policy'. Their 2006 conference, which attracted conservation developers (no contradiction), environmental management corporations, environmental 'service' providers, state and federal regulators, venture capitalists and representatives of the US Army Corps of Engineers, among others, was entitled 'Environmental Banking: Cultivating This Green Frontier'.¹⁰

For these and other environmental capitalists nature has indeed become a new frontier, and not unlike earlier 'frontiers', that frontier became almost instantaneously financial. An 'environmental derivatives' market very quickly sprang up whereby ecological credits are bundled together and sold in bulk to speculative financiers banking on the increased price of already established credits. The World Bank opened its BioCarbon Fund in 2004, capitalized with an initial \$30 million and aiming for \$100 million, which allows investors (minimum investment US\$2.5 million) to contribute to carbon sequestration in return for an income generated by the sale of credits. Since 2005, in line with Kyoto targets, the European Union has begun trading in and regulating carbon credits. While the Environmental Protection Agency runs an emission trading system in the US it is purely voluntary, as is the Chicago Climate Exchange, recently established by green capitalists and NGOs.

This intensified commodification, marketization and financialization of nature is of course an integral element of a much larger project of neoliberalism.¹¹ Neoliberalism's substitution of private market economic measurement

for social calculation, and its insistence that anything of social worth must be tradable in the global market, applies precisely to the emergence of new markets in ecological commodities, mitigation banking and environmental derivatives. The power of this bundling of nature into tradable bits of capital should not be underestimated, but nor should it be exaggerated. The neo-liberalization of nature is far from complete, not without its obstacles, and anything but a smooth process.¹² That said, while the financialization of nature may only be in its infancy, its scope and trajectory are already becoming clear.

Financialized credits for wetlands and carbon, industrial emissions and wildlife are part of a larger process by which the production of nature is being dramatically intensified and its dimensions multiplied. The colonization of terrestrial biology is very much a part of this process. Biotechnology allows science to bore into and transform the core of specific life forms and this has myriad results. On the one hand, new commodities are produced, such as genetically modified (GM) seeds, crops and other organisms, themselves involving commodification on a completely new scale: subatomic commodities such as laboratory-manufactured genes. This in turn has set off a frantic episode of bio-prospecting in which corporate pirates scour the natural world for patentable genetic material. This may involve sending doctoral scientific adventurers to the Amazon to collect samples – raiders of a future nature? – but it might just as well involve the laboratory manufacture of genetically transformed mammals. Donna Haraway has explored the implications of this regarding one of the first such genetically modified mammals, OncoMouse™, produced by Harvard University and now owned and trademarked by Dow Chemical.¹³ The surgical and medicinal applications of myriad new genetic commodities raise the prospect of a cyborg world, she has suggested, that dissolves sharp boundaries between human and non-human nature.

THE PRODUCTION OF NATURE, ALL THE WAY DOWN

Capitalist nature has always been commodified in the sense that naturally-provided use values, whether iron ore or labour power or services such as the ability to transport, are plucked for productive consumption and in turn alter the form of nature: the earth is gouged, soil is colonized, workers are transformed by work (physically and mentally, for better or worse), and transport technology shortens the temporal distance between spatially separate places. The social provision of sustenance has always involved a certain ‘production of nature’.¹⁴ In capitalist societies, however, the production of nature mutates

from an incidental and fragmented reality to a systemic condition of social existence, from a local oddity into a global ambition. The notion of the production of nature – quite literally the alteration of the form of received nature (whether or not that nature has been previously transformed by human work) – may sound quite quixotic insofar as nature seems to be the epitome of that which neither is nor can be socially produced. Yet the universal production of nature was written into the DNA of capitalist ambition from the start; neoliberal globalization is only its latest incarnation.

The production of nature under capitalism generates its own distinct ideologies. On the one hand the radical objectification of nature in the process of industrial production both generates and reaffirms the positing of nature as an external reality vis-à-vis society, humanity, the social. Nature is broadly conceived as a repository of biological, chemical, physical and other processes that are outside the realm of human causation or creation and the repository too of identifiable objects – subatomic and molecular, specific organisms and species, terrestrial ‘bodies’, and so forth. Modern science serves up such objects conceptually as discrete targets of instrumental social labour and simultaneously ratifies this purview of an external, exploitable natural world. But western societies, among others, generally also consider human beings as themselves subjects of nature, integral parts of the natural world. However instinctive the externalist conception of nature may be today, as recently as the eighteenth century in Europe it was far from general. Apart from anything else, theological and absolutist ideologies of nature were utterly antagonistic to conceptions of an external nature. On the face of it, of course, a nature wholly beyond and different from society is an untenable idea, quite literally absurd, and the externalist conception fostered its own alter ego: nature may indeed be external to society, but it is simultaneously universal. That is, the entire world – human and non-human – is subject to natural events and processes. The contradiction between these externalist and universalist conceptions has grown into a hallmark of capitalist ideologies of nature.¹⁵

In a remarkable section in *The German Ideology*, Marx and Engels captured the power of this capitalist production of nature. Responding critically to Feuerbach’s idealism, they observed that science, trade and industry are provided with their raw material by the ‘sensuous activity’ of human beings:

So much is this activity, this unceasing sensuous labour and creation, this production, the basis of the whole sensuous world as it now exists, that, were it interrupted only for a year, Feuerbach would not only find an enormous change in the natural world, but

would very soon find that the whole world of men and his own perceptive faculty, nay his own existence, were missing.

‘In all this’, they continued, ‘the priority of external nature remains unasailed’:

nature, the nature that preceded human history, is not by any means the nature in which Feuerbach lives, it is nature which today no longer exists anywhere (except perhaps on a few Australian coral-islands of recent origin) and which, therefore, does not exist for Feuerbach.¹⁶

Although Marx never developed this critique in any comprehensive way, its implications are clear. Insofar as the unresolved contradiction between an external and a universal world marks capitalist ideologies of nature, the critical response is not simply a denial of either or both components of this ideology; as ever, this ideology is not simply wrong but rather presents a distorted and inverted vision of the world, with its origins in a very specific class perspective. The externality and universality of nature are real enough, but these are not to be taken as ontological givens. The ideology of external-cum-universal nature harks back to a supposedly edenic, pre-human or supra-human world, systematically erasing the very *processes* of externalization which make such an ideology sensible. (By corollary, of course, this external conception of nature becomes a powerful ideological tool for justifying racial, gender, class, sexual and other forms of social difference and inequality as ‘natural’ rather than social in their genesis.) Crucial here is the eclipse of the capitalist labour process through which nature is commodified and thereby externalized. By contrast, Marx and Engels make social labour central to nature, so much so that the production of nature becomes ‘the basis of the whole sensuous world as it now exists’.

If we live now amidst ‘social nature’,¹⁷ none of this in any way denies the power or existence of ‘natural’ processes. Gravity, biological process, chemical and geological change cannot be summarily suspended, and in no way owe their origins or continued operation to social labour, however much their effects may in various, limited ways be countermanded, altered, re-routed, or differently engineered: flying in a plane is a powerful way to countermand gravity – as long as the fuel lasts – but the work involved in making the plane, and making it fly, just as powerfully affirms the so-called laws of nature. It goes without saying that ‘natural’ science has done an unprecedented job of deciphering how nature works, but this world-historical achievement

comes at a cost. The processes of externalization and objectification have facilitated inordinate efforts at the *mastery* of nature, but the resulting lack of self-reflexivity – the refusal to incorporate an understanding of how human labour, much of it science-driven, has itself transformed the ‘natural’ world – has been highly destructive. On one side, the apparently infinite regress of physicists’ and cosmologists’ discoveries of smaller and smaller sub-atomic particles, registered only as electronic blips or images on a computer screen, or as abstract mathematical results, increasingly seems to reflect the operative scientific logic more than what may or may not be happening ‘in nature’. On the other, the lack of such reflexivity has not only facilitated a massive industrial transformation of nature but fostered a broad-based societal blindness about the destructive results of this process, from air and water pollution to nuclear weaponry to global warming. The theoretical power of Donna Haraway’s work has been precisely the integration of this insight concerning the centrality of labour into her revisioning of biotechnological nature.

Two clarifications are important here. First, many Marxists and critics alike have argued that human societies generally, and capitalism in particular, attempt a certain ‘domination of nature’. For the Frankfurt School, on one side of the political spectrum, this was always conceived as an inevitable condition of the human metabolism with nature.¹⁸ On the other hand deep ecologists, Gaia hypothesists and other ecological essentialists recognize a parallel attempt at domination, but they reject it not as inevitable but as a destructive social choice. There is no question that the broad intent of science in a capitalist society is explicitly aimed at the domination of nature, but that project embodies an aggressive externalization of nature, as we have seen, and in different ways this externalization of nature is also embodied, whatever the degree of lamentation, in the domination-of-nature thesis. The *production-of-nature* thesis, by contrast, not only assumes no such comprehensive domination but leaves radically open the ways in which social production can create accidental, unintended even counter-effective results vis-à-vis nature. In political terms, the domination-of-nature thesis is a cul-de-sac: if such domination is an inevitable aspect of social life, the only political alternatives are an anti-social (literally) politics of nature or else resignation to a kinder, gentler domination. The German Greens split along exactly this fissure in the 1980s with one wing veering toward eco-anarchism while the other joined the Bundestag.

The second clarification is related to the first. The production of nature thesis makes no pretence to the *control* of nature. At best, we may want to think about a Gramscian hegemony over nature but even that formulation may be too extreme. Just as capitalists never entirely control the production

process, its results, or the global capitalism it generates, so capitalist society does not entirely control nature. Global warming and genetically modified organisms are certainly socially produced but they are by no means entirely controlled. Nor should future societies entertain any fantasy of controlling nature.

By the same token, it should also be emphasized that the production of nature is in no way synonymous with a social constructionist vision of nature.¹⁹ While the best constructionist accounts emphasize the combined material and discursive construction of nature²⁰ and often invite a discussion of race, gender, sexuality and other forms of social difference in relation to nature, the connection between materiality and discourse often remains vague, the social origins of discourses are underspecified, and the source of change in given social constructions of nature is obscure: nature 'is seen' (passive voice) as one thing or another in such constructions, but the social processes by which it might come to be 'seen' differently are rarely broached. At best, discourse itself is often seen to steer social change, and discursive constructionism comes to substitute for, instead of augment, any sustained focus on social production or the political-cum-social economy of nature. The production-of-nature thesis, by contrast, expresses the historical generation of ideological discourse within shifts in social productive practices – 'external' nature, for example, as an expression of the commodification of nature.

The explosion of ecological commodification and capitalization has significantly deepened the production of nature. It became a mantra of 1990s constructionism that 'nature is discursive all the way down', but the dramatic transformation of 'socio-nature'²¹ today signals, if anything, that it is the *regulation and production* of nature that threatens to penetrate 'all the way down'. Currency rates and interest rates, credit markets and stock markets have always somewhat affected the regulation of raw material extraction, but the deepening of the production of nature today adds a wholly new dimension. Although this process is certainly in its infancy, it is intensifying rapidly, and financial markets are now increasingly in a position to influence if not orchestrate a range of environmental policies: which forms of pollution are produced and which are eradicated, how much environmental degradation is acceptable, where should it go and where should it not go, who pays. The capitalization of nature explicitly regulates such *social* decisions according to financial markets. When the price of ecological credits changes, investment priorities do too; when the weather changes, the price of pollution credits changes as traders anticipate greater or lesser generation of electricity; when interest and currency rates change, environmental policies are directly affected by capital moving in or out. Exactly this logic led Lawrence Summers,

chief economist at the World Bank before taking the presidency of Harvard, to argue that Africa was 'underpolluted': the environmentally induced loss of life in more developed countries was more expensive to the world economy compared with the cheapness of life (lost wages) in Africa.

The fundamental victory of late-twentieth century environmental politics was precisely to highlight and isolate environmental destruction as the integral result of capitalist patterns of production and consumption. If still incompletely, the market has now retaken and recolonized environmental practices. Bitter mutual antagonism is replaced by financial partnership: 'what's kind to nature' is also 'kind to profits'.²² This represents a sweeping political co-optation and victory for capital and a defeat for environmental cum socialist politics. For capital, most crucially, it represents not just an ideological victory but an extraordinary economic opportunity insofar as it opens up an entirely new domain for capital accumulation. Any choice over what kinds of environments and landscapes are to be produced, and for what purposes, increasingly passes from any semblance of broad social discussion into narrow class control orchestrated through the market.

If the commodification and financialization of nature 'all the way down' marks the new phase of the production of nature, a parallel shift is also underway. The fantasy guiding the biotechnological conquest of nature involves nothing less than an effort to bypass the very externality of nature that capitalism itself promulgated. Dependence on the availability of external nature for every cycle of production represents a considerable obstacle and source of insecurity for capital. Insofar as organisms can be harvested and engineered to reproduce themselves continuously, the need for continued plunder of external nature for raw materials is attenuated. The social reproduction of nature in the laboratory – whether in a university science park or a corporate farmer's field, a hospital operating room or a test subject's daily regime of pharmaceuticals – obviously does not entirely supplant the power or necessity of external nature. Rather, it absorbs nature more fully and completely within the circuits of capital. For all that capitalism is more voracious than ever in vacuuming a supposedly external nature in search of commodifiable use values, we can also glimpse the start of a new capitalist regime whereby the task of producing a usable nature begins to pass from so-called external to social nature.

The increasingly social reproduction of nature incrementally infiltrates any remnant of a recognizably external nature. 'Second nature', in Hegel's or Marx's terms, is today less and less produced out of and in opposition to first nature; rather first nature comes to be produced from within and as a part of this second nature itself.²³ Such a self-reproduction of value – reproducing

OncoMouse™ biologically in the lab, or GM seed in a corporate field or factory – is the wet dream of capital, increasingly within reach in some sectors of production. Nature is not only thereby ‘improved’, but this improved nature also reproduces itself with very little additional work. Should this nature escape, however – a free OncoMouse™ daring to reproduce in the walls of its Harvard lab or GM seed blown free to reproduce in neighbouring Saskatchewan fields – it must be hunted down, re-commodified, privatized, certainly brought to court to determine the ownership of that nature, and, should its ownership be found unsanctioned, killed.²⁴

FROM THE FORMAL TO THE REAL SUBSUMPTION OF NATURE

So how do these developments transform our theoretical and political understanding of the social relationship with nature? Many Marxists and critics alike assume that Marx’s conception of nature can be equated with the realm of use values, seeing exchange value as the social contribution to the commodity form. While parts of volume one of *Capital* might be read this way, the same work produces a much more nuanced argument that avoids such a simple externalization of nature. Marx is quite eloquent about the ways in which the development of capitalism intensifies and transforms not just Feuerbach’s nature, but *human* nature generally, *as labour*. Manufacturing crushes the worker under what he calls the ‘Juggernaut’ of capital. Buried within his discussion of the fate of labour at the hands of capital is an argument that now applies to the fate of nature.

In simple manufacturing, Marx says, ‘the organisation of the social-labour process is purely subjective’: insofar as individual workers are either hired or are not, they agree to sell their labour power for a wage or they do not, and they still retain considerable control over the immediate production process. The accumulation of capital is also still organized largely through the expansion of absolute surplus value; that is, larger and larger numbers of workers are employed in more and more extensive places of production using more and more raw material. Modern industry, which takes over from simple manufacturing, not only intensifies the dependence of the worker on the system of production but, Marx says, reverses the polarity of power. Modern industry constitutes ‘a productive organism that is purely objective, in which the labourer becomes a mere appendage to an already existing material condition of production’. Capital accumulation here is increasingly accomplished in the form of relative surplus value, garnered through the intensification of production via technological innovation and other forms of labour control. The labourer is increasingly stripped of his or her control

and individuality, replaced by the 'collective labourer'. Elaborate systems of industrial machinery operate 'only by means of associated labour' in which 'the co-operative character of the labour-process is... a technical necessity dictated by the instrument of labour' rather than by the labourer.²⁵

Both historically and logically, this shift plays a major part in Marx's critique of capitalism and its evolution. He codified it in terms of a distinction between the formal and the real subsumption of labour to capital. The formal subsumption of labour took place when workers entered a wage relationship with capital but still maintained some immediate, creative control over the daily labour process. The real subsumption of labour to capital occurred when workers became cogs in the machinery of modern industry, hence the reversed valence of power. Not only were they subsumed as a result of the direct wage relation; they were now subsumed within the multidimensional web of capitalist technology and social organization. If Marx was theorizing in a world that barely yet knew the modern assembly line, nor the interventionist state, this insight can nonetheless be generalized beyond the narrow confines of the industrial factory. Whether working in the office or in transporting materials to and from market, whether in raw material extraction or in the global factory, modern day workers are even more intensely integrated into what the Autonomia Marxists usefully came to call the 'social factory'.

Marx conceived the shift from the formal to the real subsumption of labour in simultaneously historical and analytical terms, and the same twinning of historical and analytical intent applies to the conceptual framework necessary to understand the current production of *nature*. With the formal subsumption of nature, capital accumulation is facilitated predominantly by a continual expansion in the conversion of extracted material into objects of production. More and more oil and wood, cotton and coal are extracted for production. Colonialism functioned as a primary strategy for, among other things, this formal subsumption of nature. Either by economic or military means (or more usually both), ruling classes in the centers of capitalist production scouted the earth in search of appropriate use values, engaging or transporting labour as part of this process. The struggles to end formal colonialism in Africa, Asia and the Caribbean, which began to succeed following World War I and intensified after World War II, may have abolished direct foreign control of many colonial governments, but did much less to circumscribe the power of European and increasingly North American corporate control over resource extraction.

The transformation to *real* subsumption is marked not simply by an intensification of this dependence of capital accumulation on nature. Rather, a two-sided shift takes place. First, while capital has always circulated through

nature, whether in agricultural production or in land ‘improvement’ of myriad kinds, the real subsumption of nature not only intensifies this circulation but transforms it from an incidental effect of capital accumulation to an intended strategy: what were once unintended consequences become strategic goals. The production of nature becomes capitalized ‘all the way down’. Second, the reverse process, namely the circulation of nature through capital, is similarly transformed from an incidental to a strategic process. This occurs in two ways. In terms of biotechnology, produced natures – whether in the body of OncoMouse™, in the offspring of a cloned Scottish sheep, in the genetic profile of seeds or other organic products (vegetable or animal) – circulate as commodities in everything from research objects to donatable body fluids and organs, meat and bread, pharmaceuticals and milk. This technological deepening raises to a new level the appropriation of relative rather than absolute surplus value.

But at the same time these produced natures circulate financially in the garb of commodity futures, ecological credits, corporate stocks, environmental derivatives, and so forth. The residue of nature in these financial ‘instruments’ may not be immediately visible, but that is hardly the point; financialized commodities would not exist without the earlier attachment of exchange value to some aspect of (produced) nature. Just as the commodity price of a swath of wetland or a residential plot is equally invisible until a social negotiation settles it, nature’s contribution to a mitigation credit or an environmental derivative remains hidden until an investor is required to justify or determine what the underlying social commodity actually looks like. At that moment, when speculators find that the sinking price of their credits and derivatives does not even entitle them to a claim over part of a Florida swamp, but rather resides in carbon long dissipated into the atmosphere or never produced in the first place, both the power and the vulnerability of the financialization of nature become starkly evident. Much as the real subsumption of labour strips the labourer of individuality, the real subsumption of nature, through its capitalization and financialization, strips nature of its specificity: a \$40 ton of unproduced Costa Rican carbon is entirely equatable – the commodity equivalent – with a \$40 ton of produced carbon from the Houston oil industry. Through its financialization, the real commodity – carbon produced and unproduced – is now integral to the multidimensional web of capitalist technology and social organization, in short the social factory. And whether carbon is or is not released into the atmosphere becomes, literally, a matter of capitalist equivocation.

This distinction between the formal and real subsumption of nature has been explored by William Boyd, Scott Prudham and Rachel Schurman.²⁶

They make a trenchant argument that different forms of nature translate into different modes of organization of industrial production; the structure of the diamond industry is quite unlike that of cattle farming, for example, due in part to the different nature-given conditions of raw material availability, transmutability and marketability. The real subsumption of nature, they suggest, takes place when certain 'biological systems – in marked contrast to extractive sectors – are industrialized and may be made to operate as productive forces in and of themselves'.²⁷ Their subsequent analysis makes a series of distinctions, for example between nature-based and non-nature-based industries, but the crucial connection aligns the formal and real subsumption of labour with the division between biological and non-biological industries. 'The key to understanding the difference between formal and real subsumption of nature', they contend, 'lies in the difference between biological and non-biological systems and the unique capacity to manipulate biological productivity'.²⁸ For them, under the formal subsumption of nature, capitalists 'confront nature as an exogenous set of material properties', whereas under the real subsumption of nature, capitalists are able 'to take hold of and transform natural production'.²⁹

Powerful as the focus on biotechnological change is, this analysis too quickly reduces the distinction between real and formal subsumption to that between biological and non-biological industries. At a very simple level, agriculture and fishing have always cultivated or confronted nature – soil, animals (domesticated or otherwise), climate – as productive forces.³⁰ By corollary, nature was never simply 'exogenous' for Marx, even when only formally subsumed by capital. Boyd, Prudham and Schurman note that for Marx, 'the distinction between the formal and real subsumption of labour turned on the distinction between absolute and relative surplus value'. But that is only part of the story. What is missing here is a recognition of the crucial role played by *cooperation* which for Marx was a product of the nature of human beings in the deepest sense.³¹ Without cooperative human labour – the innate power to work together and the larger creative ability of cooperative compared with individualized workers – the historical hegemony of relative over absolute surplus value would have been impossible. It was precisely the power of technological and social organization to harness this nature-given power of human cooperation that made the real subsumption of labour (and the institutionalization of relative surplus value) possible.

Underlying and in part explaining this lacuna concerning labour and nature is an explicit adherence by these authors to an external conception of nature: indeed they define nature as 'the nonhuman, biogeophysical world', leaving little room for any 'nature' in labour, as Marx theorized, or for labour

as fulcrum of the production of nature.³² Most important, the conflation of biological versus non-biological nature with real versus formal subsumption of nature not only elides the biology of *human* nature but also locates the real subsumption of nature too narrowly in the biological world. Even the formal subsumption of nature always deployed biological systems as forces of production, as with industrial agriculture, and today's real subsumption of nature, while crucially biological, is not entirely so. The real subsumption of nature is also orchestrated through the explosion of intellectual property rights, for example, which, on the back of capital, have bored into nature via the core of scientific discovery and invention (biological and otherwise), buttressing evolving claims concerning artistic and cultural commodity production. Just as important, ecological credits, mitigation markets and environmental derivatives – all examples of what Marx called 'fictitious capital'³³ – also play a central role. In the same way that mortgages and pensions became part of the daily life of many workers during the twentieth century, playing a crucial role in socializing the real subsumption of labour beyond the workplace (narrowly defined), the fictitious capital of ecological credits and environmental derivative markets is integral to socializing the real subsumption of nature.

Regulation theorist Michel Aglietta has argued that around the beginning of the twentieth century – precisely the period in which Woolf announced the transformation of human nature, and Lefebvre claimed that space had changed – a radical shift took place in the conditions of the reproduction of capital.³⁴ Looking specifically at the United States, Aglietta argued that the 'predominantly extensive regime of accumulation' extended itself horizontally through the geographical sway of capital and the search for surplus value, and extended itself vertically by building up 'successive layers' of industrial innovation. By contrast, the 'intensive regime of accumulation', which takes over historically, reverses this priority. It creates a 'new mode of life', integrating new norms of social consumption and new forms of state regulation with transformed forces of production.³⁵ The resulting Fordism was premised on the historical shift from the formal to the real subsumption of labour, or, as Aglietta puts it, 'the creation of collective means of production', rooted as they are in cooperative labour.³⁶ That transition is now being replicated a century later as regards the real subsumption of nature. The extensive production of nature that has characterized capitalism since its infancy has, since the 1970s, been challenged and increasingly superseded by an intensive production of nature.

CONCLUSION: NATURE AS ACCUMULATION STRATEGY

On the basis of her research on genetically transformed organisms, including OncoMouse™, Donna Haraway concluded in the late 1990s that the body now represented an accumulation strategy for capital: 'Life itself is a capital-accumulation strategy'. Cindi Katz has broadened this into a suggestion that nature per se may now represent an accumulation strategy for capital.³⁷ As the parallel with Aglietta's analysis would indicate, the emergence of nature as an accumulation strategy applies not simply to changes in the production of nature but to changes in its consumption too. The natural foods industry which sprang from 1960s hippie environmentalism, quickly became a multi-billion capitalist enterprise. Oil companies, among the world's greatest polluters, routinely advertise their decimation of nature as environmentally friendly, not least by championing their purchase of carbon credits. Recycling, once a quack demand by marginal environmentalists, is now (whatever its other merits) a major industrial sector that not only enjoys significant state subsidy and is run in some US states by the mafia, but has forcibly enlisted the work of consumers – sorting, storing and even delivering recyclables – in a very real subsumption of daily life to capital.³⁸ In 2006 WalMart, the world's largest retail chain and emblem of capitalist consumptionism, announced that it was 'going green' with organic methods, sources and products. Little wonder that establishment environmentalists could belatedly come to the obvious realization that liberal environmentalism is dead.³⁹ Actually, it is only dead as an anti-capitalist movement; it is very much alive, thriving and profiting as a multi-billion dollar enterprise in the board rooms of the same capitalist powers that it once challenged.

Remnant conservative opposition to environmentalism should not be taken as contrary to this argument. As regards wetlands, for example, the US Supreme Court seems to be squeamish about its support for existing wetlands legislation, without which the wetlands mitigation market may not expand as quickly as it otherwise would. On Kyoto, the US refusal to accept the protocols agreed on by most of the world is widely seen as a narrowly conservative and rather pugilist rejection of environmentalism. But in both cases these challenges to environmental legislation represent not so much a rejection of any and all environmental politics – George W. Bush is the son of the 'environmental president' – as a protection of some capitalist prerogatives over others. Concerning wetlands, the struggle is very much about the sanctity of private property, enlisting individual property owners against big government. The US rejection of the Kyoto accords represents an internal

ruling class jostle between more environmentally ‘friendly’ energy capitalists – think BP advertising – and more aggressive cowboy capitalists who, while quite happy to invest in the environmental market, see their immediate profits in terms of direct energy production for an expanding market. US rejection of Kyoto betokens a squabble within the global ruling class about the details of how to profit from the new environmental consciousness and who gets to profit how from the new capitalization of nature. At one level, the so-called conservatives simply have not yet caught up to the opportunities of environmental capitalism and will go down in history as such. On the other hand, they are on the side of an energy industry which is making record profits while presenting itself as environmentalist.

As with the subsumption of labour, there is no sharp historical distinction between the formal and real subsumption of nature. Just as sweatshop labour proliferates in many industries in Asia, Latin America and Africa, the extensive expansion of capital into nature remains a powerful frontier of capital accumulation, whether with bio-prospecting in the Amazon or oil drilling in the US Arctic; the outer edge of this extensive expansion today is transplanetary, the coming colonization, scientific exploration, and exploitation of what we still call ‘outer space’. What is new today is not that this horizontal integration of nature into capital has ceased, even if in some arenas it is significantly circumscribed as many raw materials become scarcer, harder to locate, and more expensive to extract. Rather, partly in response to these increasing constraints, a new frontier in the production of nature has rapidly opened up, namely a *vertical integration of nature* into capital. This involves not just the production of nature ‘all the way down’, but its simultaneous financialization ‘all the way up’. Capital is no longer content simply to plunder an available nature but rather increasingly moves to produce an inherently social nature as the basis of new sectors of production and accumulation. Nature is increasingly if selectively replicated as its own marketplace.

Writing in the mid-1970s, Aglietta detected a ‘crisis in the regime of intensive accumulation’, a crisis which in retrospect we now recognize as the harbinger of a new phase of accumulation and a restructured capitalism dominated by neoliberalism and so-called globalization.⁴⁰ In the 1980s the increasing appropriation of nature as an accumulation strategy contributed to the resolution of this regime crisis; today it promises to provide the nervous system of a new phase of capitalist accumulation. None of this happens without contradiction, of course, not least of which is that the new vertical capitalization of nature makes the fate of capitalism more dependent on nature, not less. In the past, economic recessions and depressions have traditionally provoked a slowdown in the appropriation of nature, an ironic environmen-

tal benefit amidst economic hardship. With the intensification of nature as an accumulation strategy, however, the destruction of value embedded in ecological commodities and credits both reaches further into the core of capital and threatens heightened environmental destruction. The same credit system that supposedly protects a wetland or forest can lead to its destruction when the credit system itself collapses.

Yet this does not happen without political opposition. Insofar as nature is more intensely integrated into capital as an accumulation strategy, the comprehensiveness of this social production of nature under capitalism becomes more and more apparent, and the necessity of a broad political response ever more urgent. It is important to fight GM crops, for example, on the grounds that they can contaminate and forever alter other organisms, including human beings, but if the analysis here has any meaning it also suggests that such a narrow focus on the use value of nature is not only limiting but skewed, and unlikely to generate a successful political challenge to the strategic production of nature per se. As the global capitalist class arrogates to itself comprehensive power over the production of nature, a power camouflaged in the language of markets, private property and free trade, an adequate response must be just as ambitious. In short, while struggles over GM organisms, biotechnology, working and health conditions, and other means of the capitalization of nature are of central importance, and have to be fought and won, it is just as vital to have a longer-term eye on the constitutive social relations. Put bluntly, if the production of nature is a historical reality, what would a truly democratic production of nature look like? The chance is there to take Virginia Woolf at her word, looking forward rather than backward, and to think how nature ought to change. And to think what kind of social power it will take to democratize that production of nature.

NOTES

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- 26 Boyd et al., 'Industrial Dynamics'.
- 27 Ibid., p. 555.
- 28 Ibid., p. 564.
- 29 Ibid., p. 557.
- 30 Cf. 'It seems paradoxical to assert that uncaught fish, for instance, are a means of production in the fishing industry. But hitherto no one has discovered the art of catching fish in waters that contain none': Marx, *Capital* I, p. 181.
- 31 Ibid., chapter 13.
- 32 Boyd et al., 'Industrial Dynamics', p. 568. For a revised, more sophisticated recognition of the critique of external ideologies of nature, see Prudham, 'Commodifying GMOs in Canada'.
- 33 Karl Marx, *Capital*, Volume III, New York: International Publishers, 1967, chapters 25 and 29.
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- 36 Ibid. p. 79.
- 37 Haraway, *Modest_Witness*, p. 65; see also David Harvey, 'The Body as Accumulation Strategy', *Society and Space*, 40, 1998, pp. 401-21; Cindi Katz, 'Whose Nature'.
- 38 See the essay by Heather Rogers in this volume.
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