

Marx, Engels, and metabolic rift

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*Let us not, however, flatter ourselves too much on account of our victories over nature. For each victory nature takes its revenge on us.*¹ — Friedrich Engels

Despite our assumed position as earth's dominant species, we have seen our society effectively shut down by a virus. Friedrich Engels's caution against hubris, written over a century and half ago, seems particularly apt. And while we grapple with one monster, the far deadlier beast of climactic catastrophe grows ever more menacing. Despite our scientific knowledge and technological prowess, one thing remains clear: We are not the masters over nature. We are part of nature. And the idea that we can view ourselves and our economy as existing independently of the natural world could be the end of us.

There are some who argue environmental destruction is an inevitable consequence of human existence. A cursory glance at our recent history might seem to support this. Indeed, some environmentalists argue that seven and half billion humans is simply too many. But this view is both dangerous and deeply misleading. For one thing, it's precisely the countries with the highest birth rates that consume and pollute the least.² Thus, if the poorest half of humanity disappeared in the morning, it would do nothing to improve the situation. Moreover, while blaming humanity or human nature might feel like an explanation, it does not really get us anywhere. The human species in its current form, *Homo sapiens*, has existed for at least two hundred thousand years. For much of that time, human interaction with nature was more or less harmonious. So what changed? Is it simply that there are far more of us now, or that we have the knowledge and capability to produce and consume so much? Or is there something else, perhaps rooted in the way our society is organized, that is driving us to the precipice?

One person who thought deeply about this problem was Engels' lifelong friend and collaborator Karl Marx. This is not well known, in part because of the false association of Marx's ideas with Stalinist regimes,

which in reality represented the antithesis of everything Marx stood for. Many, even among those sympathetic to Marx, assume he had little to say on ecological matters. This assumption holds that Marx saw worker's control of production—and in turn their control of nature—as the key to creating a better world. Thus, nature was simply a resource to be exploited. This view, which is sometimes described as 'productivist' or 'Promethean' (after Prometheus who stole fire from the gods and gave it to mortals), is a distortion and obscures what is actually a rich source of environmentalist thought. Far from being ambivalent about nature, Marx and Engels in fact had a profoundly nuanced and holistic understanding of humanity's place in the natural world.

Central to this understanding is the notion of *metabolic rift*, a term coined by University of Oregon academic John Bellamy Foster to describe one of Marx's key insights.³ This notion was based on cutting-edge developments in the new science of metabolism, and in particular the work of German organic chemist Justus von Liebig. Marx's writings on this topic provide a detailed analysis of the way in which capitalist cycles of extraction and production, with their incessant and growing rapidity, were driving a rift in our relationship with nature and its ancient cycles and timelines.

The essential idea is as follows: The natural world is filled with cyclical processes which have emerged and stabilized over deep time. One example is the carbon cycle, which involves the flow of carbon dioxide between the atmosphere and the oceans and plays a vital role in regulating the earth's temperature. Another involves the returning to the soil (in the form of plant and animal waste) of the nutrients necessary for further plant growth. Indeed, the basic fact, learned by every school child, that carbon dioxide is exhaled by animals as waste but is absorbed by plants as a fundamental building block is part of exactly such a process. The more

general phenomenon of one species' excretions providing nutrients for another is ubiquitous in nature, and allows for the continued recycling of essential elements. For instance, without such recycling the earth's vegetation would absorb virtually all atmospheric carbon in a few thousand years.

A metabolic rift is, in essence, the disruption of one of these cycles. Thus, the separation of animals from vegetation can lead to a rift if the animal manure does not reach the soil of the plants. The manure in turn becomes a pollutant, while the plants require synthetic fertiliser. This latter example describes a *break* in the cycle. Alternatively, a cycle may become *overloaded*. Consider the carbon cycle: Carbon dioxide (CO₂) in the atmosphere traps heat. As the atmospheric temperature increases, more and more of this CO₂ is absorbed into the oceans. When the atmosphere cools, this is reversed. Over millions of years, this process has stabilized in such a way as to keep the earth's temperature within a narrow range, one conducive to our needs. It keeps earth from being too cold, like Mars, or too hot, like Venus. In the last couple of centuries, however, through the burning of fossil fuels, enormous quantities of carbon that were buried underground and therefore cut off from the cycle have been injected into the atmosphere. This recent overloading, which is already evident in ice core data, is destabilising a vital regulatory system with potentially catastrophic consequences for life on earth.⁴

The notion that nature is filled with cyclical processes is not a new one. At an intuitive level at least, it has been known for millennia. The Roman philosopher Lucretius, whom Marx admired, conveyed this concept in his great poem *De Rerum Natura*:

Things do not utterly perish. Since nature recruits one thing from another nor suffers anything to be produced unless its production be furthered by the death of another...⁵

However, it was not until the mid-nineteenth century and the work of Justus von Liebig that these ideas began to be made concrete and scientifically rigorous. Liebig pioneered the study of metabolism (which he called *Stoffwechsel*, literally 'stuff change'), the analysis of the material cycles which are essential to life. At the time, the problem of declining soil fertility was leading to a serious crisis in food production all over Europe. Liebig demonstrated that the transport of food from the

countryside to distant towns was preventing the return to the soil of vital nutrients such as nitrogen, phosphorous, and potassium contained in food waste, animal excrement, etc. This was leading both to major pollution problems in the cities and a long-term fertility crisis in the land. In his copious scientific papers, Liebig eloquently explained the principle of recycling:

All of the innumerable products of vitality resume, after death, the original form from which they sprung...the complete dissolution of an existing generation becomes the source of life for a new one.⁶

Liebig's work and the new agricultural chemistry had a tremendous influence on Marx which he described to Engels as being 'more important for this matter than all the economists put together.'⁷ Before discussing this further, it is important to realise that Marx and Engels were greatly influenced by all of the science of their day; Engels in particular read omnivorously and demonstrated in his writings an astute understanding of the nature of scientific development. Of particular interest to both Marx and Engels were the discoveries of Charles Lyell in geology and Charles Darwin and Alfred Russel Wallace in biology. This work undermined the idea that the earth was a static backdrop on which human affairs unfolded; instead, it had a deep history and was ever changing. Human beings, like all other organisms, were not placed on the earth fully formed but arose gradually from much simpler organisms by a process of evolution through natural selection, forming the tip of one branch of a great tree of life.

Following from Darwin's work, we now know that not only are we part of nature, we have *co-evolved* with it. This evolutionary process has taken place over an unimaginably long time period, something which our local intuition finds very difficult to grasp. The world around us, along with its many cycles and restorative processes, was not created to suit our needs or the needs of any other organism. Instead we have adapted to it. Those organisms which did not adapt, perhaps because change came too rapidly, went extinct. The fact, for example, that we use oxygen to release energy from our food, arises from adaptations made by ancient organisms to cope with increasing amounts of oxygen in the earth's early atmosphere, a by-product of photosynthetic bacteria.⁸ For those organisms which did not make such adaptations, this increasingly prevalent oxygen was a poison.

Over time, certain natural cycles develop that on the scale of a human lifetime may seem stable and unchanging but which over longer (epochal) time periods may not be. Change in nature is often non-linear. Indeed, nature is full of ‘tipping points’. What might begin as a gradual incremental process, the melting of an ice cap in response to a slight increase in temperature say, may turn into a self-feeding cycle as the lack of reflective ice allows more heat to be trapped in the atmosphere. Given the interconnectivity of the earth’s systems, the induced ripple of change begetting change has myriad consequences: ocean acidification; the release of methane from formerly frozen tundra further raising temperature; disruption of ocean currents; etc. Thus, what begins as a gradual quantitative change can lead to dramatic qualitative change.

This notion of change is central to Marx’s ideas. While observing the rapid growth of the capitalist system all around him, Marx saw that the political and economic structures of our society were not permanent fixtures. Instead they had a history. Different social structures came and went. Capitalism was just the latest one, emerging from the decaying feudal order. Various naive idealistic explanations existed for this: that this was part of a divine plan or an upward march of reason. Just as Darwin’s theory had dispensed with these sorts of teleological explanations of the history of the natural world, Marx sought to do likewise at the level of human society.

More than this, Marx realized that human society could not be understood in isolation from nature. This is in contrast to most of mainstream economic theory, which sees the economic sphere as existing independently of the natural sphere and unconstrained by scientific laws. This artificial separation allows many economists to regard economic growth as inconsequential to the external world, treating the economy as a sort of ‘perpetual motion machine’ flouting fundamental physical principles such as the laws of thermodynamics.⁹ Marx grounded his theory in the material world, realizing that before humans could pursue politics, art, literature, or anything we would call culture, they must first interact with nature to provide food, shelter, clothing, etc. From the outset, Marx argued:

The first premise of all human history is, of course, the existence of living human individuals. Thus, the first

fact to be established is the physical organisation of these individuals and their consequent *relation to the rest of nature*.¹⁰

Marx beautifully and profoundly described nature as ‘man’s inorganic body’. In a direct physical sense this is clear. The old aphorism ‘you are what you eat’ extends naturally to the air we breathe, the material forces we feel, and the more general environment we interact with. We are a part of, and a product of, that environment. But Marx went further. Not only is the environment the source of humanity’s physical nourishment, it is also the source of our spiritual nourishment; the sustenance for our very human soul derives from nature’s wellspring. All of us gain solace and inspiration from forest walks and ocean waves, from Byron’s ‘cloudless climes and starry skies’. As such, the grotesque spectacle of an oil-drenched bird or a plastic-laden hedgerow impacts us at the most visceral level.

Nature is man’s inorganic body—nature, that is, insofar as it is not itself human body. Man lives on nature—means that nature is his body, with which he must remain in continuous interchange if he is not to die. That man’s physical and spiritual life is linked to nature means simply that nature is linked to itself, for man is a part of nature.¹¹

Generalizing Liebig’s work, Marx saw this interaction as a form of *social metabolism*. In *Capital*, Marx studied in depth the effects that the priorities of capitalism were having on this metabolic interface. Noting that under capitalism, goods are produced not for immediate use or human need but for the wealth they can generate by sale, Marx observed that:

...in a capitalist commodity economy this realm of second nature takes on an alienated form, dominated by exchange value rather than use value, leading to a *rift in this universal metabolism*.¹²

Regarding the crisis in soil fertility, he wrote:

Capitalist production collects the population together in great centres...disturbing the metabolic interaction between man and the earth, i.e. it prevents the return to the soil of its constituent elements consumed by man in the form of food and clothing; hence it hinders the operation of the eternal natural condition for the lasting fertility of the soil.¹³

He went on to say that:

Capitalist agriculture produces conditions that provoke

an irreparable rift in the interdependent process of social metabolism, a metabolism prescribed by the natural laws of life itself.¹⁴

Marx described European farming as a 'robbery system' whereby not only were agricultural workers and small tenant farmers robbed of the fruits of their labour through exploitation and oppressive rental schemes, the very nutrients were robbed from the soil. Nowhere was this truer than in Ireland, where, as Marx observed, British imperialism had held back virtually all attempts at industrial development and made the country almost purely agricultural. The result of Ireland's role as breadbasket for the British Empire was a long-term depletion in the fertility of Irish soil. As Marx wrote:

England has indirectly exported the soil of Ireland without even allowing its cultivators the means of replacing the constituents of the exhausted soil.¹⁵

Marx and Engels paid a great deal of attention to Ireland and its suffering under British imperialism. They studied the effects of colonialism at every level, the economic, the social, and especially the ecological, creating detailed statistical reports. Interestingly, Engels wrote extensive notes for a *History of Ireland* which, as a basis for studying Irish history, contained detailed ecological and geological descriptions of the land and climate. Unfortunately, the work was never finished.

All of this has been extensively studied (and made accessible) by the Maynooth sociologist Eamon Slater, and anyone interested in this topic can find a plethora of fascinating research articles on Slater's webpage IrishMetabolicRifts.com.

Marx saw what he described as the *colonisation of the Irish soil* as unfolding over two stages separated by the Great Famine.¹⁶ In the pre-famine years, those working the land were usually cottiers who lived on small rented holdings. Commodity crops like grain were grown for sale in order to pay rent while, on what land remained, potatoes provided subsistence. Such workers had some interest in maintaining the fertility of the soil they worked using methods like animal manuring. However, the precarious nature of their tenure and the level of exploitation they were under meant that such measures as they could implement were at best temporary. Often their position was at the bottom of a chain of landlords and middlemen. The compound effect of this was staggeringly high rents that usually forced the renter, on

top of an already gruelling existence, into providing extra labour for landowners as a means of subsidy. Marx described this process as 'rack-renting', likening it to a medieval torture device. What is worse, the profits extracted from such rental schemes were rarely put back into the land, but were invested overseas.

Whatever little small holders and cottiers were able to provide for maintaining soil nutrition during this period evaporated during the Great Famine as a large proportion of this population starved to death or emigrated. The forced dependence of so much of the population on one crop meant that when a fungal blight ravaged potato harvests, the effects were catastrophic. In turn these effects were greatly exacerbated by the indifference and cruelty of the British government's market-based response. From the 1840s onwards, amid the wholesale clearance by landlords of peasants and cottiers from their estates, the rate of soil deterioration accelerated far beyond the pre-famine levels.¹⁷ Writing in the 1860s, Marx noted that:

Since the exodus, the land has been underfed and over-worked partly from the injudicious consolidation of farms, and partly because, under the [previous] system, the farmer in a great measure trusted to his labourers to manure the land for him. Hence, sterilisation (gradual) of land, as in Sicily by the ancient Romans (Ditto in Egypt).¹⁸

Marx went on to observe the criminal irony that a country that had been forced into an almost entirely agricultural state was rapidly losing the ability to feed even its own (substantially reduced) population.

Though the situation in Ireland was rather extreme, the general crisis in soil fertility was the subject of huge public debate throughout Europe. Liebig argued in favour of healing this metabolic rift (and the chronic pollution problems in the cities) by establishing schemes to return human waste to the land.¹⁹ As this would likely involve serious economic and social reconfiguration, it was deemed cheaper and easier to simply dispose of waste in the sea and import South American bird guano to provide much-needed nitrogen for the soil.²⁰ This was not a long-term solution, and by the 1890s these sources were running out.

The development in 1909, by the German chemists Fritz Haber and Carl Bosch, of a technique for taking nitrogen out of the atmosphere to produce ammonia (NH₃)

allowed for the production of synthetic fertilisers (and explosives) on an industrial scale.²¹ While leading to an enormous increase in food production, this did not actually heal the metabolic rift in the natural soil fertility cycle. It simply hid it while in fact destabilizing other natural processes. The excessive use of nitrogen fertiliser actually further reduces the soil's fertility, leading to a vicious cycle of ever-increasing need. This problem of over-fertilisation to maximise crop yield is a very serious one, leading to all manner of environmental problems: destruction of river, lake, and coastal habitats; fish kills; and global warming and ozone depletion.²² In fact, nitrogen compounds such as ammonia and methane, arising from industrial agriculture, are key components in the photochemical smog which plagues cities like Paris and Los Angeles.

Modern agribusiness and its commodification of food production have replicated on a global scale the kinds of local metabolic disruption Marx observed in Ireland in the nineteenth century. Over recent decades, pressure from institutions like the IMF and World Bank forced countries of the global south to prioritise cash crops such as coffee or flowers, destroying self-sufficiency and leading to soil degradation since such crops were often ill-suited to the local environment. The removal of trade barriers forced local farmers out of business and into ever-expanding city slums. Remaining farmers are burdened with the increasing costs of synthetic fertilisers and pesticides as they are forced to eke out an existence on ever more marginal land. The imposition of such free trade policies has even led to some utterly bizarre scenarios, such as Mexico, the home of corn domestication, becoming a net importer of U.S. corn.²³

Capitalist agriculture leads to disjointed zones of homogeneity: vast landscapes of monocultures such as palm oil plantations or giant barns of almost genetically identical animals. These zones are artificially separated from each other and the natural cycles under which their organisms evolved. This has all manner of negative consequences, not least of which is the horrendous cruelty to the animals. One consequence is particularly noteworthy: the selection of ever more virulent pathogens. While deadly viruses exist in nature, their spread is often contained by various natural buffers. For example, in order for a virus to be transmitted its host must survive long enough to interact with a similar organism,

one which is susceptible to infection. Provided the natural environment is sufficiently diverse, such interactions may be relatively infrequent, thus selecting for more benign pathogens; the really deadly ones will kill their hosts long before the opportunity for transfer.

In the artificial environment of a factory farm, where thousands of genetically similar organisms (selected to fit a set of narrow profit-optimizing criteria) are crammed together, the most lethal pathogens can spread with ease. As the evolutionary biologist Rob Wallace points out, capitalist food production creates conditions which select for the most virulent pathogens. In his 2016 book *Big Farms Make Big Flu*, Wallace makes a very convincing case that various swine and avian viruses, as well as Zika and Ebola, have to a significant extent been aided and abetted by global agribusiness.²⁴ It is as yet a little early to say to what extent Covid-19 fits into Wallace's thesis, although there is no doubt that capitalist methods of workplace organization (especially meatpacking) and the underfunding of vital public services such as healthcare have greatly aided the spread and lethality of this particular pathogen.

It is one thing to acknowledge that human activity has led to a dangerous destabilisation of vital natural processes. This, at least at the local level, was clear to Liebig. It is also clear to essentially all of the scientific community today. Marx's contribution to this story was to connect this disruption not simply with human activity but with the way capitalism organizes this activity. Marx saw capitalism not as some natural culmination of human development but as simply its latest phase. This system, whose emergence was connected with revolutionary scientific and technological discoveries, was more dynamic than any that had passed before. It was also more unstable and filled with contradictions. As Marx noted:

On the one hand, there have started into life industrial and scientific forces, which no epoch of former human history had ever suspected. On the other, there exist symptoms of decay far surpassing the horrors recorded of the latter times of the Roman Empire.²⁵

Despite its immense productive capabilities and the tremendous impetus to scientific and cultural development, capitalism has led to poverty, war, and environmental destruction on an extraordinary scale. Famine and want co-exist with abundance. Technological breakthroughs are not a source of mutual celebration

but a threat to livelihoods. Marx's goal was to make sense of these contradictions, to understand how such a system emerged and what was driving it.

In his analysis, Marx pointed out certain salient features of capitalism. While production involves the combined efforts of workers all over the world, those workers have little or no say in what they produce or how it is used. Instead, production is directed by private interests in a relentless competition for profits. To survive, individual capitalist firms strive to produce as efficiently as possible, seeking new technologies, new products, and new markets. Outgrowing one's competitors is paramount. Thus, the system expands, disrupts, extracts, and exploits, endlessly commodifying every aspect of our lives. As Marx and Engels so memorably wrote: Constant revolutionising of production, uninterrupted disturbance of all social conditions, everlasting uncertainty and agitation distinguish the capitalist epoch from all earlier ones. All fixed, fast-frozen relations, with their train of ancient and venerable prejudices and opinions, are swept away, all new-formed ones become antiquated before they can ossify. All that is solid melts into air, all that is holy is profaned.²⁶

To understand the ecological consequences of this, two points here are crucial. The first concerns planning: The intensity of capitalist competition means that the system operates on short-term cycles. Firms that cannot maintain profitability go under. Thus, any potential for long-term planning is severely constrained amid pressure for ever speedier returns on investment. Worse, the oft-devastating environmental implications of short-term profiteering are of little interest to those reaping the rewards. Writes Engels:

What cared the Spanish planters in Cuba who burned down forests on the slopes of mountains and obtained from the ashes sufficient fertiliser for one generation of highly profitable coffee trees—what cared they that the heavy tropical rainfall washed away the unprotected stratum of the soil, leaving behind only bare rock!²⁷

Moreover, there is continual pressure for these cycles to speed up. Thus, while in 1925 it took about four months to raise a one-kilogram chicken, today, with selective breeding, hormones, and chemical feed, a two-kilogram bird can be raised in six weeks.²⁸ This tendency puts an ever-increasing strain on established metabolic cycles,

driving further rifts as nature's timelines and capital's timelines increasingly diverge.

The second point is growth. While the need for a planned, efficient, free public transport system is blindingly obvious, manufacturers of automobiles continue to produce and push ever more and ever larger vehicles. To increase sales, all manner of products, especially electronic devices, are constructed to have shorter and shorter life spans: so-called 'in-built obsolescence'. We are drowning in stuff. The most common type of marine debris found in our ocean is now plastic.²⁹ Yet the need for further growth is advocated ad nauseam by our political and business leaders, by economists and pundits. It is tempting to think of this simply as a collective insanity, a sort of religious fundamentalism that has captured the minds of our leaders resulting in a society of reckless accumulation. This has it backwards. The drive toward unbounded economic expansion is an intrinsic feature of capitalism. As the Marxist scholar Ian Angus puts it: Capital exploits labour and nature to produce goods that can be sold at more than the cost of production, in order to accumulate more capital, and the process repeats. Growth ideology does not *cause perpetual accumulation—it justifies it*.³⁰

The disruptive effects of human activity on nature are of course not unique to capitalism. For example, the clear-cutting of forests by ancient farmers to make cultivatable land had often profound consequences on local eco-systems. As Engels writes:

When the Italians of the Alps used up the pine forests of the southern slopes, so carefully cherished on the northern slopes, they had no inkling that by doing so they were depriving their mountain springs of water for the greater part of the year, making possible for them to pour still more furious torrents on the plains during the rainy season...³¹

Under capitalism, however, the scale and pace of this disruption is at a level that far surpasses anything our ancestors were capable of. It happens despite the fact that we have a deeper understanding of the laws of nature and the consequences of our actions than at any previous time. Worse, it happens amid a host of cleaner alternatives.

Capitalism locks us into rationales and cycles of its own. These capitalist cycles of extraction and production may come to feel natural or inevitable. Marx realised they

are anything but. Most of humanity is disconnected from these processes or at least from controlling them. Human labour, rather than serving human need and being honed to be ecologically harmonious and individually fulfilling, takes an alien form. Most workers have no say over the work they do, and often what is produced is useless and destructive. Consider the energy and resources put into industries like advertising or arms manufacture. Even those with power are subservient to the demands of the system, locked in a competitive spiral of incessant production for production's sake. Marx understood this disconnect only too well.

In estranging from man (1) *nature*, and (2) himself, his own active functions, his life activity, estranged labor estranges the species from man. It changes for him the life of the species into a means of individual life.³²

This prioritization of the individual life is illusory, setting up as it does a false choice between the individual and society as a whole. Just as humanity can only survive through a continued interaction with the natural world, individual humans can only thrive as part of a human society. The alienation of the individual from nature and in particular from the human species as a whole, obstructs us from having a rational and harmonious relationship with the natural world. This obstruction is evident when one considers the staggering inadequacy of market-based policies to tackle the climate crisis. Proposals such as the Irish Green Party's carbon tax regard human beings as nothing more than individual consumers whose purchasing decisions need to be nudged in a more responsible way.³³ This invariably makes life harder on the poor, who may not be able to afford an electric vehicle to make a work commute which is ill-served by ramshackle public transport. Yet it allows the rich to buy their way out of responsibility. Moreover, such a view denies the possibility of human solidarity and of achieving a society based on cooperation and democratic principles, a necessary goal if our species is to endure.

Alienation can lead us to naive explanations: that the problem is too many people or an inevitable consequence of scientific and technological development. Some may conclude that the solution involves a return to purely 'organic' techniques and a rejection of modern methods. But this is to throw the proverbial baby out along with the bathwater. Over the centuries, humani-

ty has by hard graft and incremental progress amassed a wealth of scientific wisdom. This is not our enemy, and neither is our productive capability. What we lack is control over our own interaction with nature and an ability to rationally and justly determine how this interaction can best enhance human existence. In this spirit Marx wrote that:

Freedom, in this sphere...can consist only in this, that socialised man, the associated producers, govern the human metabolism with nature in a rational way, bringing it under their own collective control rather than being dominated by it as a blind power; accomplishing it with the least expenditure of energy and in conditions most worthy and appropriate for their human nature.³⁴

Our species faces a colossal ecological challenge. Survival depends on forming the greatest mass movement that has ever existed to radically reconfigure our political and economic structures. With each day that passes, ever-growing rifts with our natural environment make the task of rebuilding more difficult. To succeed, our struggle must be guided by an appreciation for the best of human imagination and ingenuity in all its various forms: the sciences, arts and humanities, the realms of technology and economics, and the day to day experience and wisdom of those countless millions on whose labour we all rely. The work of Marx and Engels, its scope, diversity, and revolutionary insight, epitomizes the acme of that spirit.

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