7 Marx's ecology and its historical significance[1]

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Introduction

> For the early Marx the only nature relevant to the understanding of history is human nature ... Marx wisely left nature (other than human nature) alone.
>
> Lichtheim (1961: 245)

Although Lichtheim was not a Marxist, his view here did not differ from the general outlook of Western Marxism at the time he was writing. Yet this same outlook would be regarded by most informed observers on the Left today as laughable. After decades of explorations of Marx's contributions to ecological discussions and publication of his scientific–technical notebooks, it is no longer a question of whether Marx addressed nature, and did so throughout his life, but whether he can be said to have developed an understanding of the nature–society dialectic that constitutes a crucial starting point for understanding the ecological crisis of capitalist society.[2]

Due to mounting evidence, Marx's ecological contributions are increasingly acknowledged. Yet not everyone is convinced of their historical significance. A great many analysts, including some self-styled ecosocialists, persist in arguing that such insights were marginal to his work, that he never freed himself from 'Prometheanism' (a term usually meant to refer to an extreme commitment to industrialization at any cost), and that he did not leave a significant ecological legacy that carried forward into later socialist thought or that had any relation to the subsequent development of ecology. In a recent discussion in the journal *Capitalism, Nature, Socialism*, a number of authors argued that Marx could not have contributed anything of fundamental relevance to the development of ecological thought, since he wrote in the nineteenth century, before the nuclear age and before the appearance of polychlorinated biphenyls (PCBs), chlorofluorocarbons (CFCs) and DDT – and because he never used the word 'ecology' in his writings. Any discussion of his work in terms of ecology was therefore a case of taking 120 years of ecological thinking since Marx's death and laying it 'at Marx's feet' (de Kadt and Engel-Di Mauro, 2001).

My own view of the history of ecological thought and its relation to socialism, as articulated in my book *Marx's Ecology*, is quite different (Foster, 2000a). In this, as in other areas, I think we need to beware of falling into what Edward Thompson called 'the enormous condescension of posterity' (2001: p.6). More specifically, we need to recognize that Marx and Engels, along with other early socialist thinkers, like Proudhon (in *What is Property?*) and Morris, had the advantage of living in a time when the transition from feudalism to capitalism was still taking place or had occurred in recent memory. Hence the questions that they raised about capitalist society and even about the relation between society and nature were often more fundamental than what characterizes social and ecological thought, even on the Left, today. It is true that technology has changed,

introducing massive new threats to the biosphere, undreamed of in earlier times. But, paradoxically, capitalism's antagonistic relation to the environment, which lies at the core of our current crisis, was in some ways more apparent to nineteenth- and early twentieth-century socialists than it is to the majority of today's green thinkers. This reflects the fact that it is not technology that is the primary issue, but rather the nature and logic of capitalism as a specific mode of production. Socialists have contributed in fundamental ways at all stages in the development of the modern ecological critique. Uncovering this unknown legacy is a vital part of the overall endeavor to develop an ecological materialist analysis capable of addressing the devastating environmental conditions that face us today.

Metabolism in Liebig and Marx

I first became acutely aware of the singular depth of Marx's ecological insights through a study of the Liebig–Marx connection. In 1862 the great German chemist Justus von Liebig published the seventh edition of his pioneering scientific work, *Organic Chemistry in its Application to Agriculture and Physiology* (first published in 1840 and commonly referred to as his *Agricultural Chemistry*). The 1862 edition contained a new, lengthy and, to the British, scandalous introduction. Building upon arguments that he had been developing in the late 1850s, Liebig declared the intensive, or 'high farming', methods of British agriculture to be a 'robbery system', opposed to rational agriculture.[3] They necessitated the transportation over long distances of food and fiber from the country to the city – with no provision for the recirculation of nutrients, such as nitrogen, phosphorus and potassium, which ended up contributing to urban waste and pollution in the form of human and animal wastes. Whole countries were robbed in this way of the nutrients of their soil. For Liebig this was part of a larger British imperial policy of robbing the soil resources (including bones) of other countries. 'Great Britain', he declared:

> deprives all countries of the conditions of their fertility. It has raked up the battlefields of Leipsic, Waterloo and the Crimea; it has consumed the bones of many generations accumulated in the catacombs of Sicily; and now annually destroys the food for a future generation of three millions and a half of people. Like a vampire it hangs on the breast of Europe, and even the world, sucking its lifeblood without any real necessity or permanent gain for itself.[4]

The population in Britain was able to maintain healthy bones and greater physical proportions, he argued, by robbing the rest of Europe of their soil nutrients, including skeletal remains, which would otherwise have gone into nurturing their own soils, allowing their populations to reach the same physical stature as the English.

'Robbery', Liebig suggested, 'improves the art of robbery'. The degradation of the soil led to a greater concentration of agriculture among a small number of proprietors who adopted intensive methods. But none of this altered the long-term decline in soil productivity. Britain was able to maintain its industrialized capitalist agriculture by importing guano (bird droppings) from Peru as well as bones from Europe. Guano imports increased from 1700 tons in 1841 to 220000 tons only six years later (Ernle, 1961: 369).[5]

What was needed in order to keep this spoliation system going, Liebig declared, was the discovery of 'beds of manure or guano . . . of about the extent of English coalfields'. But existing sources were drying up without additional sources being found. By the early 1860s North America was importing more guano than all of Europe put together. 'In the

last ten years', he wrote, 'British and American ships have searched through all the seas, and there is no small island, no coast, which has escaped their enquiries after guano. To live in the hope of the discovery of new beds of guano would be absolute folly.'

In essence, rural areas and whole nations were exporting the fertility of their land: 'Every country must become impoverished by the continual exportation of corn, and also by the needless waste of the accumulated products of the transformation of matter by the town populations.' All of this pointed to 'the law of restitution' as the main principle of a rational agriculture. The minerals taken from the earth had to be returned to the earth. 'The farmer' had to 'restore to his land as much as he had taken from it', if not more.

The British agricultural establishment, needless to say, did not take kindly to Liebig's message, with its denunciation of British high farming. Liebig's British publisher, rather than immediately translating the 1862 German edition of his *Agricultural Chemistry* as in the case of previous editions, destroyed the only copy in its possession. When this final edition of Liebig's great work was finally translated into English it was in an abridged form under a different title (*The Natural Laws of Husbandry*) and without Liebig's lengthy introduction. Hence the English-speaking world was left in ignorance of the extent of Liebig's critique of industrialized capitalist agriculture.

Nevertheless, the importance of Liebig's critique did not escape the attention of one major figure residing in London at the time. Karl Marx, who was then completing the first volume of *Capital*, was deeply affected by Liebig's critique. In 1866 he wrote to Engels, 'I had to plough through the new agricultural chemistry in Germany, in particular Liebig and Schönbein, which is more important for this matter than all of the economists put together.' Indeed, 'to have developed from the point of view of natural science the negative, i.e. destructive side of modern agriculture', Marx noted in volume one of *Capital*, 'is one of Liebig's immortal merits' (1976: 638).

Marx's two main discussions of modern agriculture both end with an analysis of 'the destructive side of modern agriculture'. In these passages Marx makes a number of crucial points: (1) capitalism has created an 'irreparable rift' in the 'metabolic interaction' between human beings and the earth, the everlasting nature-imposed conditions of production; (2) this demanded the 'systematic restoration' of that necessary metabolic relation as 'a regulative law of social production'; (3) nevertheless the growth under capitalism of large-scale agriculture and long-distance trade only intensifies and extends the metabolic rift; (4) the wastage of soil nutrients is mirrored in the pollution and waste in the towns – 'In London,' he wrote, 'they can find no better use for the excretion of four and a half million human beings than to contaminate the Thames with it at heavy expense'; (5) large-scale industry and large-scale mechanized agriculture work together in this destructive process, with 'industry and commerce supplying agriculture with the means of exhausting the soil'; (6) all of this is an expression of the antagonistic relation between town and country under capitalism; (7) a rational agriculture, which needs either small independent farmers producing on their own, or the action of the associated producers, is impossible under modern capitalist conditions; and (8) existing conditions demand a rational regulation of the metabolic relation between human beings and the earth, pointing beyond capitalist society to socialism and communism (Marx, 1976: 636–9, 1981: 948–50, 959).

Marx's concept of the metabolic rift was the core element of this ecological critique.

The human labor process itself was defined in *Capital* as 'the universal condition for the metabolic interaction between man and nature'. It followed that the rift in this metabolism meant nothing less than the undermining of the 'everlasting nature-imposed condition of human existence' (1976: 290). Further, there was the question of the sustainability of the earth – i.e. the extent to which it was to be passed on to future generations in a condition equal or better than in the present. As Marx wrote:

> From the standpoint of a higher socio-economic formation, the private property of particular individuals in the earth will appear just as absurd as private property of one man in other men. Even an entire society, a nation, or all simultaneously existing societies taken together, are not owners of the earth. They are simply its possessors, its beneficiaries, and have to bequeath it in an improved state to succeeding generations as *boni patres familias* [good heads of the household]. (1981: 911).

The issue of sustainability, for Marx, went beyond what capitalist society, with its constant intensification and enlargement of the metabolic rift between human beings and the earth, could address. Capitalism, he observed, 'creates the material conditions for a new and higher synthesis, a union of agriculture and industry on the basis of the forms that have developed during the period of their antagonistic isolation'. Yet, in order to achieve this 'higher synthesis', he argued, it would be necessary for the associated producers in the new society to 'govern the human metabolism with nature in a rational way' – a requirement that raised fundamental and continuing challenges for post-revolutionary society (Marx, 1976: 637, 1981: 959).

In analyzing the metabolic rift Marx and Engels did not stop with the soil nutrient cycle, or the town–country relation. They addressed at various points in their work such issues as deforestation, desertification, climate change, the elimination of deer from the forests, the commodification of species, pollution, industrial wastes, toxic contamination, recycling, the exhaustion of coal mines, disease, overpopulation and the evolution (and co-evolution) of species.[6]

Marx and the materialist conception of nature

After having the power and coherence of Marx's analysis of the metabolic rift impressed on me in this way, as reflected in my early writings on this subject (Foster, 1999), I began to wonder how deeply imbedded such ecological conceptions were in Marx's thought as a whole. What was there in Marx's background that could explain how he was able to incorporate natural scientific observations into his analysis so effectively? How did this relate to the concept of the alienation of nature, which along with the alienation of labor was such a pronounced feature of his early work? Most of all, I began to wonder whether the secret to Marx's ecology was to be found in his materialism. Could it be that this materialism was not adequately viewed simply in terms of a materialist conception of *human* history, but also had to be seen in terms of *natural* history and the dialectical relation between the two? Or, to put it somewhat differently, was Marx's materialist conception of history inseparable from what Engels (1941: 67) had termed the 'materialist conception of nature'? Had Marx employed his dialectical method in the analysis of both?

The search for an answer to these questions took me on an intellectual journey through Marx's works, and the historical–intellectual context in which they were written,

which became *Marx's Ecology* (Foster, 2000a). Let me mention just a few highlights of the story I uncovered – since I do not have the space to explore it all in detail here, and because part of my purpose here is to add additional strands to the story. My account differs from most present-day accounts of Marx's development in that it highlights the formative significance of Marx's doctoral thesis on Epicurus, the greatest of the ancient materialists, and goes on to situate Marx and Engels's lifelong engagement with developments in the natural sciences. This includes Marx and Engels's opposition to the natural theology tradition, particularly as manifested by Malthus, their treatment of Liebig's work on nutrient cycling and its relation to the metabolic rift, and finally their creative encounter with Darwin, coevolution, and what has been called 'the revolution in ethnological time' (Trautmann, 1987: 35 and 220) following the discovery of the first prehistoric human remains.

In most interpretations of Marx's development his early thought is seen as largely a response to Hegel, mediated by Feuerbach. Without denying Hegel's significance I argue that Marx's formative phase is much more complex than is usually pictured. Along with German idealism, Marx was struggling early on with ancient materialist natural philosophy and its relation to the seventeenth-century scientific revolution, and the eighteenth-century Enlightenment. In all of this Epicurus loomed very large. For Kant, 'Epicurus can be called the foremost philosopher of sensibility', just as Plato was the foremost philosopher 'of the intellectual'. Epicurus, Hegel claimed, was 'the inventor of empiric natural science'. For Marx himself, Epicurus was the 'the greatest figure of the Greek Enlightenment' (Foster, 2000a: 49–51).

Epicurus represented, for Marx, most importantly, a non-reductionist, non-deterministic materialism, and had articulated a philosophy of human freedom. In Epicurus could be found a materialist conception of nature that rejected all teleology and all religious conceptions of natural and social existence. In studying Epicurus' natural philosophy, Marx was addressing a view that had had a powerful influence on the development of European science and modern naturalist–materialist philosophies, and one that had at the same time profoundly influenced the development of European social thought. In the Epicurean materialist worldview, knowledge of the world started with the senses. The two primary theses of Epicurus' natural philosophy make up what we today call the principle of conservation: nothing comes from nothing, and nothing being destroyed is reduced to nothing. For Epicureans there was no scale of nature, no set of sharp, unbridgeable gaps between human beings and other animals. Knowledge of Epicurus provides a way of understanding Marx's deep materialism in the area of natural philosophy. His study of ancient and early modern materialism brought Marx inside the struggle over the scientific understanding of the natural world in ways that influenced all of his thought and was deeply ecological in its significance, since it focused on evolution and emergence, and made nature, not God, the starting point. Moreover, Marx's dialectical encounter with Hegel has to be understood in terms of the struggle that he was carrying on simultaneously regarding the nature of materialist philosophy and science.

Darwin had similar roots in natural philosophy, linked to the anti-teleological tradition extending back to Epicurus, which had found its modern exponent in Bacon. We now know, as a result of the publication of Darwin's notebooks, that the reason that he waited so long – 20 years – before making public his theory on species transmuta-

tion was that his theory had strong materialist roots, and thus raised the issue of heresy in Victorian England. Darwin's view went against all teleological explanations, such as those of the natural theology tradition. He presented an account of the evolution of species that was dependent on no supernatural forces, no miraculous agencies of any kind, but simply on nature's own workings.

Marx and Engels greeted Darwin's theory immediately as 'the death of teleology', and Marx described it as 'the basis in natural history for our view' (see Foster, 2000a: 196–207 and 212–21). Not only did they study Darwin intensely, they were also drawn into the debates concerning human evolution that followed immediately on Darwin's work, as a result of the discovery of the first prehistoric human remains. Neanderthal remains had been found in France in 1856, but it was the discovery of prehistoric remains that were quickly accepted as such in England in Brixham Cave in 1859, the same year that Darwin published his *The Origin of Species*, that generated the revolution in ethnological time, erasing forever within science the biblical chronology for human history/prehistory. Suddenly it became clear that the human species (or hominid species) had existed in all probability for a million years or longer, not simply a few thousand. (Today it is believed that hominid species have existed for around 7 million years.)

Many major works, mostly by Darwinians, emerged in just a few years to address this new reality, and Marx and Engels studied them with great intensity. Among these were Charles Lyell's *Geological Evidences of the Antiquity of Man* (1863), Thomas Huxley's *Evidence as to Man's Place in Nature* (1863), John Lubbock's *Prehistoric Times* (1865), Darwin's *Descent of Man* (1871), and a host of other works in the ethnological realm, including Lewis Henry Morgan's *Ancient Society* (1881).

Out of Marx and Engels's studies came a thesis on the role of labor in human evolution that was to prove fundamental. Inspired by the ancient Greek meaning for organ (*organon*) or tool, which expressed the idea that organs were essentially the 'grown-on' tools of animals, Marx referred to such organs as 'natural technology', which could be compared in certain respects to human technology. A similar approach was evident in Darwin, and Marx was thus able to use Darwin's comparison of the development of specialized organs in plants and animals to that of specialized tools (in chapter 5 of *The Origin of Species* on 'Laws of Variation') to help explain his own conception of the development of natural and human technology. The evolution of natural technology, Marx argued, rooting his analysis in *The Origin of Species*, was a reflection of the fact that animals and plants were able to pass on through inheritance organs that had been developed through natural selection in a process that might be called '"accumulation" through inheritance'. Indeed, the driving force of evolution for Darwin, in Marx's interpretation, was 'the gradually accumulated [naturally selected] inventions of living things'.[7]

In this conception, human beings were to be distinguished from animals in that they more effectively utilized tools, which became extensions of their bodies. Tools, and through them the wider realm of nature, as Marx said early on in his *Economic and Philosophic Manuscripts*, became the 'inorganic body of man'. Or, as he was to observe in *Capital*, 'thus nature becomes one of the organs of his [man's] activity, which he annexes to his own bodily organs, adding stature to himself in spite of the Bible'.[8]

Engels was to develop this argument further in his pathbreaking work, 'The Part Played by Labour in the Transition from Ape to Man' (written in 1876, published

posthumously in 1896). According to Engels's analysis – which derived from his materialist philosophy, but which was also influenced by views voiced by Ernst Haeckel a few years before – when the primates, who constituted the ancestors of human beings, descended from the trees, erect posture developed first (prior to the evolution of the human brain), freeing the hands for tool-making. In this way, '*the hand became free* and could henceforth attain ever greater dexterity and skill, and the greater flexibility thus acquired was inherited and increased from generation to generation. Thus the hand is not only the organ of labor, *it is also the product of labor*' (Engels, 1940: 281; original emphasis).

As a result, early human beings (hominids) were able to alter their relation to their local environment, radically improving their adaptability. Those who were most ingenious in making and using tools were most likely to survive, which meant that the evolutionary process exerted selective pressures toward the enlargement of the brain and the development of language (necessary for the social processes of labor and tool-making), leading eventually to the rise of modern human beings. Thus the human brain, like the hand, in Engels's view, evolved through a complex, interactive set of relations, now referred to by evolutionary biologists as 'gene-culture co-evolution'. All scientific explanations of the evolution of the human brain, Stephen Jay Gould has argued, have thus far been theories of gene-culture co-evolution, and 'the best 19th century case for gene-culture co-evolution was made by Frederick Engels' (Gould, 1987: 111).

All of this points to the fact that Marx and Engels had a profound grasp of ecological and evolutionary problems, as manifested in the natural science of their day, and that they were able to make important contributions to our understanding of how society and nature interact. If orthodoxy in Marxism, as Lukács taught, relates primarily to method, then we can attribute these insights to a very powerful method. But one that, insofar as it encompasses both a materialist conception of natural history and of human (i.e. social) history, has not been fully investigated by subsequent commentators. Behind Marx and Engels's insights in this area lay an uncompromising materialism, which embraced such concepts as emergence and contingency, and which was dialectical to the core.

Marxist ecological materialism after Marx

Engels's *Dialectics of Nature* is known to incorporate numerous ecological insights. But it is frequently contended that Marxism after Marx and Engels either missed out on the development of ecological thought altogether or was anti-ecological and that there were no important Marxian contributions to the study of nature after Engels until the Frankfurt School and Alfred Schmidt's *The Concept of Nature in Marx*, first published in 1962 (Castree, 2000: 14 and Foster, 2001: 465–7). This position, however, is wrong. There were in fact numerous penetrating Marxist contributions to the analysis of the nature–society relation, and socialists played a very large role in the development of ecology, particularly in its formative stages. The influence of Marx and Engels's ideas in this respect was not confined to the nineteenth century.

But it is not just a question of the direct inheritance of certain propositions with respect to nature–ecology. Marx and Engels employed a materialist conception of nature that was fundamental to the major revolutions in the science of their day (as evident in Darwin's theory), and combined it with a dialectic of emergence and contingency. A very large part of this was reflected in both socialist and scientific thought in the immediately succeeding generations. Among the socialists (some of them leading

natural scientists) who incorporated naturalistic and ecological conceptions into their thinking, after Marx and through the 1940s, we can include such figures as William Morris, Henry Salt, August Bebel, Karl Kautsky, Rosa Luxemburg, V.I. Lenin, Nikolai Bukharin, V.I. Vernadsky, N.I. Vavilov, Alexander Oparin, Christopher Caudwell, Hyman Levy, Lancelot Hogben, J.D. Bernal, Benjamin Farrington, J.B.S. Haldane and Joseph Needham – and in the more Fabian tradition, but not unconnected to Marx and Marxism, Ray Lankester and Arthur Tansley. Bukharin employed Marx's concept of the metabolism of nature and society in his writings, and explicitly situated human beings in the biosphere. 'If human beings', he wrote

> are both products of nature and part of it; if they have a biological basis when their social existence is excluded from account (it cannot be abolished!); if they are themselves natural magnitudes and products of nature, and if they live within nature (however much they might be divided off from it by particular social and historical conditions of life and by the so-called 'artistic environment'), then what is surprising in the fact that human beings share in the rhythm of nature and its cycles? (Bukharin, 2005: 101)

Kautsky in his *The Agrarian Question*, following Liebig and Marx, addressed the problem of the soil nutrient cycle, raised the question of the fertilizer treadmill, and even referred to the dangers of the intensive application of pesticides – all in 1899! Luxemburg addressed ecological problems in her letters, discussing the disappearance of songbirds through the destruction of their habitat. Lenin promoted both conservation and ecology in the Soviet Union, and demonstrated an awareness of the degradation of soil fertility and the breaking of the soil nutrient cycle under capitalist agriculture – the Liebig–Marx problem.

The Soviet Union in the 1920s had the most developed ecological science in the world. Vernadsky had introduced the concept of the biosphere in a dialectical framework of analysis that reaches down to the most advanced ecology of our day. Vavilov used the historical materialist method to map out the centres of the origin of agriculture and the banks of germplasm throughout the globe, now known as the Vavilov areas. Oparin, simultaneously with Haldane in Britain, developed the first influential modern materialist explanation for the origin of life on earth based on Vernadsky's biosphere concept – a theory that was to have an important impact on Rachel Carson's concept of ecology (Foster, 2000a: 241–4; Carson, 1998: 229–30).

Yet this early Marxist ecological thought, or rather the traditions that sustained it, largely died out. Ecology within Marxism suffered something of a double death. In the East in the 1930s Stalinism literally purged the more ecological elements within the Soviet leadership and scientific community – not arbitrarily so since it was in these circles that some of the resistance to primitive socialist accumulation was to be found. Bukharin was executed. Vavilov died of malnutrition in a prison cell in 1943. At the same time in the West, Marxism took an often extreme, avidly anti-positivistic form. The dialectic was seen as inapplicable to nature – a view often associated with Lukács, although we now know that Lukács's position was somewhat more complex.[9] This affected most of Western Marxism, which tended to see Marxism increasingly in terms of a human history severed for the most part from nature. Nature was relegated to the province of natural science, which was seen as properly positivistic within its own realm. In Lukács, Gramsci and Korsch, marking the Western Marxist revolt of the 1920s,

nature was increasingly conspicuous by its absence. Nature entered into the Frankfurt School's critique of the Enlightenment, but the nature under consideration was almost always human nature (reflecting the concern with psychology), and rarely so-called 'external nature'. There was no materialist conception of nature. Hence genuine ecological insights were rare.

If an unbroken continuity is to be nonetheless found in the development of socialist nature–science discussions and ecological thought, it survived (though largely unacknowledged) primarily in Britain, where a continuous commitment to a materialist dialectic in the analysis of natural history was maintained. A strong tradition in Britain linked science, Darwin, Marx and dialectics. Although some of the negative features of this tradition, which has been referred to as a 'Baconian strand in Marxism', are well known, its more positive ecological insights have never been fully grasped (Wood, 1959: 145).

Any account of the ecology of British Marxism in this period has to highlight Caudwell, who, although he died at the age of 29 behind a machine-gun on a hill in Spain fighting for the Republic in the Spanish Civil War, left an indelible intellectual legacy. His *Heredity and Development*, perhaps the most important of his science-related works, was suppressed by the Communist Party in Britain due to the Lysenkoist controversy (he was anti-Lysenkoist) and so was not published until 1986.[10] But it contains an impressive attempt to develop an ecological dialectic. Haldane, Levy, Hogben, Needham, Bernal and Farrington – as previously noted – all developed ecological notions (although Bernal's legacy is the most contradictory in this respect). All indicated profound respect not only for Marx and Darwin but also for Epicurus, who was seen as the original source of the materialist conception of nature. The influence of these thinkers carries down to the present day, in the work of later biological and ecological scientists, such as Steven Rose in Britain, and Richard Lewontin, Richard Levins, and the late Stephen Jay Gould in the USA.

Haldane was a deep admirer of the work of British biologist Charles Elton, the great pioneer in animal ecology and ecosystem analysis, whose work strongly influenced Rachel Carson. Referring to the dialectics of nature evident in Elton's ecological invasions analysis (which criticized the use of pesticides and the human transformation of the environment that encouraged such use), Haldane (1985: 137) observed: 'Elton is not so far as I know a Marxist. But I am sure Marx would have approved of his dialectical thinking.' Indeed, for Haldane, the problem of the growing ecological strains brought on by capitalist development made the question of 'back to nature' unavoidable, if somewhat misdirected. A society no longer geared primarily to profits and prestige, he suggested, probably

> should reject a great many artificialities, including stiff collars, bombing, aeroplanes, and high speed motor cars. But we realize that a complete return to nature would mean living without clothes, houses, cookery, or literature. All such slogans as 'back to nature' are meaningless unless we consider the economic system within which the change is to operate, and very often, as in this case, we find that within a better economic system the change would be largely unnecessary. (Haldane, 1938)[11]

Needham was to question the relation between the 'conquest of nature' and social domination. He saw the alienation of nature by class society as the reason that 'the growing

pollution of the environment by man's waste-products' was 'hardly recognized as a danger until our own time' (Needham, 1976: 300–301).

Prominent Marxian (and Darwinian) contributions to the understanding of ecology and evolution, building on this same ecological materialist tradition, were later to emerge, as indicated, in the work of such thinkers as Stephen Jay Gould, Richard Lewontin and Richard Levins in the USA, who have advanced dialectical conceptions of nature. As ecologist Richard Levins says of his own development:

> I first met dialectical materialism in my early teens through the writings of the British Marxist scientists J.B.S. Haldane, J.D. Bernal, Joseph Needham, and others, and then on to Marx and Engels. It immediately grabbed me both intellectually and aesthetically. A dialectical view of nature and society has been a major theme of my research ever since. I have delighted in the dialectical emphasis on wholeness, connection and context, change, historicity, contradiction, irregularity, asymmetry, and the multiplicity of phenomena, as a refreshing counterweight to the prevailing reductionism then and now. (Lewontin and Levins, 2007: 367)

Ecology, Lewontin and Levins have insisted, stands not only for the wholeness of life, but increasingly for its alienation as well, due to the ecological depredations of capitalist production. 'For humans ecology is a social ecology' (Ibid.: 203). Hence the rifts in the human metabolism with nature brought on by capitalism require social solutions that are revolutionary in nature.

Materialism and the rise of the ecosystem concept

In order to grasp more fully the complex relation between materialist ecology and historical materialism from the late nineteenth to the early twentieth century, I would like to focus on two figures in Britain who were more Fabian than Marxist, but clearly socialists in the broader sense – namely Ray Lankester (1847–1929) and Arthur Tansley (1871–1955). Ray Lankester taught at University College, London, and Tansley was his student there. Lankester was Huxley's protégé and was considered the greatest Darwinian scientist of his generation. When he was a boy, Darwin and Huxley, who were friends of his father, both played with him. Lankester was also a young friend of Karl Marx and a socialist, though not himself a Marxist. He was a frequent guest at Marx's household in the last few years of Marx's life. Marx and his daughter Eleanor also visited Lankester at his residence in London. Marx and Lankester had in common, above all, their materialism. Marx was interested in Lankester's research into degeneration – the notion that evolution did not necessarily simply go forward – and made an attempt to get Lankester's work published in Russian. Lankester wrote to Marx that he was absorbing 'your great work on Capital . . . with the greatest pleasure and profit'. Lankester was to become one of the leading ecologically concerned thinkers of his time. He wrote some of the most powerful essays that have ever been written on species extinction due to human causes, and discussed the pollution of London and other ecological issues with an urgency that was not found again until the late twentieth century.[12]

Arthur Tansley was the foremost plant ecologist in Britain of his generation and the originator of the concept of ecosystem. He was to become the first president of the British Ecological Society. Tansley was deeply influenced by Lankester, along with the botanist Francis Wall Oliver, in his years at University College, London. Like Lankester, Tansley was a Fabian-style socialist and an uncompromising materialist. And like

Lankester, who wrote a scathing criticism of Henri Bergson's concept of vitalism or the *élan vital*, Tansley directly challenged attempts to conceive evolutionary ecology in anti-materialist, teleological terms.[13]

In the 1920s and 1930s a major split occurred in ecology. In the USA Frederic Clements and others developed the important concept of ecological succession (successive stages in the development of plant 'communities' in a particular region culminating in a 'climax' or mature stage linked to certain dominant species). But in a much more controversial move, Clements and his followers extended this analysis to a concept of super-organism meant to account for the process of succession. This ecological approach inspired other innovations in ecological theory in Edinburgh and South Africa. South African ecological thinkers, led by Jan Christian Smuts, introduced a concept of 'holism' in the ecological realm, most notably in Smuts's book *Holism and Evolution* (1926), which was to lead to modern conceptions of deep ecology. Smuts, who was usually referred to as General Smuts because of his military role in the Boer War (he fought on the side of the Boers), was one of the principal figures in the construction of the apartheid system. How much Smuts himself contributed directly to the development of apartheid may be disputed, but he was a strong advocate of the territorial segregation of the races and what he called 'the grand white racial aristocracy'. He is perhaps best remembered worldwide as the South African general who arrested Gandhi. Smuts was South African minister of defense from 1910 to 1919, and prime minister and minister of native affairs from 1919 to 1924. He was sometimes seen as a figure soaked in blood. When the Native Labour Union demanded political power and freedom of speech, Smuts crushed it with violence, killing 68 people in Port Elizabeth alone. When black Jews refused to work on Passover, Smuts sent in the police, and 200 were killed on his orders. When certain black tribal populations in Bondelwaart refused to pay their dog tax, Smuts sent in planes and bombed them into submission. Not surprisingly, Smuts's ecological holism was also a form of ecological racism, since it was a holism that contained natural–ecological divisions along racial lines.

The legendary opponent of Smuts's holistic philosophy, in the great 'Nature of Life' debate that took place at the British Association for the Advancement of Science meetings in South Africa in 1929, was the British Marxist biologist Lancelot Hogben (who had a position at the University of Cape Town at that time). Hogben not only debated Smuts – opposing his materialism to Smuts's holism, and attacking Smuts for his racist eugenics – but also reportedly hid black rebels fleeing the racist state in a secret compartment in his basement. Another major opponent of Smuts was the British Marxist mathematician Hyman Levy, who, in his *The Universe of Science*, developed a critique of Smuts's holism along similar lines to those of Hogben (Anker, 2001: 41–75 and 118–49; Smuts, 1926; Hogben, 1930; Levy, 1933; and for Smuts's racial views see Smuts, 1930: 92–4).

In 1935 Tansley found himself increasingly at odds with anti-materialist conceptions of ecology that were then gaining influence, and entered the lists against ecological idealism. Tansley wrote an article for the journal *Ecology* entitled 'The Use and Abuse of Vegetational Concepts and Terms' that declared war on Clements, Smuts and Smuts's leading follower in South African ecology, John Phillips. In one fell swoop Tansley attacked the teleological notions that ecological succession was always progressive and developmental, always leading to a climax; that vegetation could be seen as constituting

a super-organism; that there was such a thing as a biotic 'community' (with members), encompassing both plants and animals; that 'organismic philosophy', which saw the whole universe as an organism, was a useful way to understand ecological relations; and that holism could be seen as both cause and effect of everything in nature. Smuts's holistic view, Tansley claimed, was 'at least partly motivated by an imagined future "whole" to be realised in an ideal human society whose reflected glamour falls on less exalted wholes, illuminating with a false light the image of the "complex organism"' (Tansley, 1935: 299). This was possibly a polite way of referring to the system of racial stratification that was built into Smutsian holistic ecology.

In combating this type of mystical holism and super-organicism, and introducing the concept of ecosystem in response, Tansley turned to the systems theory utilized in Levy's *The Universe of Science* and at the same time referred to materialist conceptions of dynamic equilibrium in natural systems going back to Lucretius (Epicurus' Roman follower and author of the great philosophical poem *The Nature of Things*). 'The fundamental conception', represented by his new ecosystem concept, Tansley argued, was that of

> the whole system (in the sense of physics), including not only the organism complex, but also the whole complex of physical factors forming what we call the environment of the biome – the habitat factors in the widest sense. Though the organisms may claim our primary interest, when we are trying to think fundamentally we cannot separate them from their special environment, with which they form one physical system. . . . These ecosystems, as we may call them, are of the most various kinds and sizes. They form one category of the multitudinous physical systems of the universe, which range from the universe as a whole down to the atom. (Tansley, 1935: 299)

Following Levy, Tansley emphasized a dialectical conception: 'The systems we isolate mentally are not only included as part of larger ones, but they also overlap, interlock, and interact with one another. The isolation is partly artificial, but it is the only possible way in which we can proceed.'

Rather than seeing ecology in terms of a teleological order, Tansley stressed disruptions to that order. He referred to 'the destructive human activities of the modern world', and presented human beings as an 'exceptionally powerful biotic factor which increasingly upsets the equilibrium of pre-existing ecosystems and eventually destroys them, at the same time forming new ones of very different nature'. 'Ecology', he argued, 'must be applied to conditions brought about by human activity', and for this purpose the ecosystem concept, which situated life within its larger material environment, and penetrated 'beneath the forms of the "natural" entities', was the most practical form for analysis. Tansley's ecosystem concept was, paradoxically, more genuinely holistic and more dialectical than the super-organicism and 'holism' that preceded it, because it brought both the organic and inorganic world within a more complex materialist synthesis (Anker, 2001: 152–6; Tansley, 1935: 303).

The dialectics of the alienation of nature and society

The concept of metabolism was eventually to become crucial to developing the ecosystem analysis arising from Tansley, with leading systems ecologists such as Eugene Odum employing the notion of metabolism to all levels from the cell up to the ecosystem (Odum, 1969). Since Marx was the pioneer thinker to employ this concept in the social

relation to nature, tying it to labor and production under capitalism, it is not surprising that a great deal of research by environmental sociologists and others has emerged of late, focusing on his socio-ecological concept of metabolic rift, and using it to explore the major rifts in the biosphere related to: climate change, the destruction of the oceans, problems of the soil, devastation of the forests and so on (Dickens, 2004: 58–90; Clark and York, 2005, 2008; Clausen and Clark, 2005; Clausen, 2007; Mancus, 2007). Other work has investigated the way in which Marx, in line with his metabolism argument, built thermodynamics into the very fabric of his critique of political economy in *Capital*. Marx in this way was to help inspire much of the thinking that has come to characterize ecological economics (a great deal of which was influenced by his work in its early stages). Paul Burkett, in particular, has built on these insights to develop a contemporary Marxist ecological economics (Burkett, 2006; Burkett and Foster, 2006, 2008; Foster and Burkett, 2008).

Some environmental commentators of course persist in claiming that Marx believed one-sidedly in the struggle of human beings against nature, and was thus anthropocentric and anti-ecological, and that Marxism as a whole carried forth this original ecological sin. But there is mounting evidence, as we have seen, of Marx's very deep ecological penetration and of the pioneering insights of socialist ecologists, which has conclusively pulled the rug out from under such criticisms.

What Marx and Marxism have illuminated above all, in this area, are the historic causes of ecological alienation/exploitation in modern systems of class-based production. In *The Grundrisse* Marx observed:

> It is not the *unity* of living and active humanity with the natural, inorganic condition of their metabolic exchange with nature, and hence their appropriation of nature, which requires explanation or is the result of a historic process, but rather the *separation* between these inorganic conditions of human existence and this active existence, a separation which is completely posited only in the relation of wage labor and capital. (Marx, 1973: 489; see also Marx and Engels, 1975: 39–41).

This destructive separation between humanity and nature is not inherent to the human condition, but the product of a given set of alienated social, economic and ecological relations that the world must now transcend.

Notes

1. This chapter is a revised, expanded and updated version of an article that first appeared under the title 'Marx's ecology in historical perspective' in *International Socialism*, 96 (Autumn 2002): 71–86.
2. On the strengths of Marx's ecological analysis see Foster (2000a) and Burkett (1999).
3. Except where otherwise indicated, all the brief quotes from Liebig in the text below are taken from an unpublished English translation of the 1862 German edition of his *Agricultural Chemistry* by Lady Gilbert contained in the archives of the Rothamsted Experimental Station (now IACR–Rothamsted) outside London.
4. The translation of this passage from the introduction to the 1862 edition of Liebig's work follows Marald (2002: 74).
5. For a fuller discussion of Marx's ecological argument and its relation to the nineteenth-century guano trade see Foster and Clark (2003: 186–201).
6. Documentation of Marx's various ecological concerns can be found in Foster (2000a) and Burkett (1999). The problem of local climate change was raised by Engels and Marx in their time (speculation on temperature changes due to deforestation); see Engels's notes on Fraas in Marx and Engels (1999: 512–15).
7. Marx (1971: 294–5); Darwin (1968: 187); Marx (1976: 493); on Marx's use of organic/inorganic see Foster and Burkett (2000: 403–25).

8. Marx (1974: 328, 1976: 285–6). See also Foster and Burkett (2000: 403–25).
9. On the dialectics of nature and ecology in Marx and Lukács, see Foster (2008: 50–82).
10. Lysenkoism was an erroneous doctrine associated with the work of the Russian agronomist Trofim Denisovich Lysenko that de-emphasized genetic inheritance in favor of a notion of the plasticity of the life cycle. For a balanced discussion of Lysenkoism, see Levins and Lewontin (1985: 163–96).
11. See also Foster and Clark (2008a).
12. See the more detailed discussions of Lankester in Foster (2000a: 221–5); and Foster (2000b: 233–5).
13. For biographical information on Tansley see Anker (2001: 7–40). For a much more extensive and detailed discussion of the Smuts–Tansley debate and its relation to Marx's ecology see Foster and Clark (2008b).

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