

'ECOLOGICAL ECONOMICS' - IN AND AFTER MARX

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At the start of *Capital* Marx wrote, 'labour is not the only source of material wealth ... labour is its father and the earth its mother'. But the radio-chemist and energy scientist Frederick Soddy commented that Marx's 'disciples ... forgot all about the mother', quoted in Martinez-Alier and Schlupmann (1990, p. 134). As a result the development of a Marxist ecological economics was delayed for well over a century, pp. 15-19.

It is widely supposed that Marx ignored the environment, or was hostile to it, or regarded it as a constant, or thought it was inexhaustible despite plunder and exploitation, or had what we now might call ecological insights but did not integrate them into his analysis in *Capital*. Such views have, however, been effectively refuted by John Bellamy Foster (1999, p. 372).

Marx's environmental analysis is, to be sure, scattered throughout Volume 1 of *Capital* and the less read Volume 3 as well as his early philosophical works and his keen and voluminous correspondence about the science of the day with Engels and others. It is also a grounded analysis, in which practical theoretical ideas emerge from his treatment of specific environmental problems of his time, which are now compounded by others of today.

In 1842 at the age of 24 and soon after completing his doctoral thesis Marx wrote 'Debates on the Law on Thefts of Wood' in which he recognised private property as theft, the interests embodied in it as antithetical to those represented in customary law and the state as the guardian of private property. Arguably, the seed of his later political economy was germinated by this early analysis of wood theft which he wrote for the *Rheinische Zeitung*. (<http://www.marxists.org/archive/marx/works/1842/10/25.htm>)

NATURE

In his writings Marx grappled with the distinctiveness of nature and natural resources in relation to human beings, or Man. 'Man is a part of nature ... Man lives from nature i.e. nature is his body and he must maintain continuing dialogue with it if he is not to die', Engels (1974, p. 328) cited in Foster (1999, p. 381). This dialogue involves, he says, flows and stocks not only of materials but also of energy - and their conversion. Engels could explain to Marx that while Man stabilised present solar heat by working, he also squandered past accumulated solar heat (through the destruction of forests, depletion of fossil fuels etc), Marx and Engels (1975a, vol 46, p. 411), cited in Foster (1999, p. 385). Energy and materials were not free gifts but can only become valuable through the action of labour. In the system of value under capitalist production relations, however, the full

costs of the reproduction of exhaustible resources do not enter the calculation. Nature is therefore 'alienated'.

LABOUR AND METABOLISM

Marx and Engels also grasped the importance of Darwinian theory. They reasoned that while living non-human organisms had through evolution, 'accumulated' internal organs or tools ('organ' being derived from the Greek for tool) that made each species uniquely equipped with a 'natural technology', mankind's distinctive evolutionary niche is the capacity to develop and use external tools and technology to modify nature. Labour is thus the 'universal condition' for what Marx called 'metabolic interaction', the process of material exchanges in which nature is appropriated 'for the satisfaction of human needs', Marx, in Theories of Surplus Value, 1861-63 and Capital 1, p. 283, 290, cited in Foster (1999). 'This ecological process of metabolism is regulated from the side of nature by natural laws governing the various physical processes involved, and from the side of society by institutionalised norms governing the division of labour and distribution of wealth etc'. Foster (1999, p. 381). Nature and social relations are therefore not independent of each other but co-evolve dialectically: 'the unity of man with nature has always existed in industry and so has the struggle with nature', Marx and Engels Collected Works vol. 5, 1975, pp. 39-41. Labour is thus a 'natural resource' that is commodified and exploited by capital - a process in which the direct connection between labour and nature is severed, Capital 1, p. 638. Under commodity production for exchange, matter and energy are continually transformed, labour is alienated from the conditions of production and physical and biological balances are violated, Burkett (1999).

SOCIAL METABOLISM, THE ECOLOGICAL CRITIQUE OF CAPITAL AND THE 'METABOLIC RIFT'

Although Marx's environmental thought was developed through his analysis of agriculture rather than industrial capitalism, its logic is more widely relevant. He saw in agriculture a kind of activity which can only be commodified by forfeiting the 'whole gamut of permanent conditions of life required by the generations', and which should not be commodified if they are to remain in balance, Marx, Capital 3, p. 754.

In the context of widely stagnating agricultural yields in the early-mid 19th century, Marx argued that increases in soil fertility were possible, though not inevitable, Foster (1999) p. 375. '(N)atural (soil) fertility is a limit, a starting point and a basis for increases in the productivity of labour', Marx, Capital 1, p. 283. Using the work on nutrient cycles by the agro-chemist Justus von Liebig, he criticised both Ricardo and Malthus. Rent, he argued, did not inhere in the quality of the soil. Improvements to land and labour productivity could support growing - and non-agricultural - populations. In 1847 he wrote: soil 'fertility is not so natural a quality as might be thought; it is closely bound up with the social relations of the time', Marx, 1963, pp. 162-3, cited in Foster (1999, p. 375). Later he understood from Liebig's own work on soil nutrients under capitalism that capitalist social relations in agriculture, through the application of chemical fertiliser and by not recycling wastes from consumption, could ruin soil as well as improve it.

Liebig had also developed and applied the concept of '*Stoffwechsel*' (metabolism), which Marx widened to 'social-ecological metabolism', Foster (1999, p. 381, footnote 5). For sure, the productivity of land could be increased by the application of labour and material resources - at that time these were organic nutrients in the shape of guano from Peru, in which Britain had a trade monopoly). But, under the pressure to maximise returns, fertiliser became 'the means of exhausting the soil', since with this intensification of the physical properties of the soil, other nutrients and minerals were wasted - not recycled - 'at heavy expense'.

'Capital' he concluded, gives rise to an 'irreparable rift' in the 'interdependent process of social metabolism, a metabolism prescribed by the natural laws of life itself', Marx, *Capital* 3, 1981, pp. 949-50 ; *Capital* 1, pp. 636-9; pp . 948-59. 'Capitalist production ... only develops the techniques and ... the social process of production by simultaneously undermining the original sources of all wealth – the soil and the worker', Marx, *Capital* 1, 1976, pp. 637-38, cited in Foster (1999, p. 379).

TOWN AND COUNTRY

Under capitalist labour relations the archetypical expression of this 'metabolic rift' is an antagonistic relationship between town and country. After the US economist Henry Carey, who also influenced Liebig, Marx called it a 'robbery system', Marx, *Capital* 1, p638. Here, he describes how towns concentrate the drivers of social progress but also break the nutrient cycle. Minerals and nutrients in food, fibres and agro-industrial raw materials are exported from farms through trade, unequal exchange and plunder, over ever-increasing distances and ever-increasing intensities of energy consumption, making the maintenance of soil fertility ever more difficult. Commodities are consumed in cities but waste resources and animal waste are not returned to the soil. In Marx's day, waste choked the towns and polluted the rivers and sea. Now it is processed (and this too has become a field of capital accumulation) but not returned to the soil, even in organic agriculture. The spatial appropriation and dislocation of metabolic flows has been a key aspect of capitalist accumulation, Burkett (2006, p. 172).

We can read into the concepts, or metaphors, of 'town' and 'country', the relations between industry and agriculture today, the extreme dislocations between food production and food producers' consumption, and between the reproduction of human society and that of its resource base. Marx saw that nature was not just a 'tap' but also a 'sink' - even if he did not foresee that the global ecological crisis would be driven by constraints in the metabolism of sinks (notably the atmosphere) as well as the exhaustion of taps.

ENTROPY

The understanding of entropy – dissipated energy – is strictly speaking part of the legacy of Marx's environmentalism, rather than of Marx himself (it is credited to the 1970s thermodynamic economics of Nicolai Georgescu-Roegen); but it is so important conceptually that it needs to be considered here. Marx had focussed on materials, and Georgescu-Roegen recognised that the law of entropy applied to materials as well as to

energy, Martinez-Alier and Schlupmann (1990, pp. 1-2) and Burkett (2006). One of the driving forces of industrial capitalism is the replacement of labour by inanimate energy. Under capitalism the physical degradation of energy and materials after production and consumption, and their reconstitution in forms potentially capable of entering into production again, is so completely at variance with the scale of capitalist production cycles that the waste process is 'irreversible': most waste is useless to capital. Depletion due to this irreversibility is accepted because it is not an immediate obstacle to the production of surplus value.

SUSTAINABLE HUMAN DEVELOPMENT

Liebig had shown that 'rational agriculture is based on the principle of restitution', cited in Foster (1999, p. 378). Marx criticised the 19th century sewage system as an example of irrationality: organic recycling would be needed as part of a rational urban-agricultural economy, to complete the metabolic cycle, Marx, Capital 3, p. 195. Nowadays it would have to be chemically detoxified prior to any restitution. The 'systematic restitution of conditions for metabolism is a regulative law of social production in a form adequate to the full development of the human race', Marx, Capital 1, pp. 637-8. Restitution is one precondition for sustained, full and generalised human development. Clearly social relations would have to be transformed for this to be possible. Marx foresaw a dialectical process, impossible under capitalist production relations, involving the systematic application of science to govern 'the human metabolism with nature in a rational way ... with the least expenditure of energy ... and the re-use of waste ... under collective (social) control ... as associated producers' Marx, Capital 3, pp. 195-7, p 959. 'Societies are not owners of the earth, they are simply its possessors, its beneficiaries, and have to bequeath it in *an improved state* [emphasis added] to succeeding generations as *boni patres familias*', Marx, Capital 3, p. 911. The improvement of the environment, it should be noted, is a stronger requirement than that of modern 'sustainable development' which stresses the *maintenance* of stocks of material and energy for future generations, Burkett (2006).

MARX'S LEGACY

Several reasons have been advanced for the long neglect of Marx's environmentalism. Scientific and academic disciplines are confining social constructs: nature does not recognise their boundaries and neither did Marx, whose project was trans-disciplinary. Mainstream economics treats the economy as being autonomous from social, political and biological processes, let alone geological, pedological, climatic and oceanic ones; and it deploys restricted conceptions of human motivation. Just as economics substitutes 'the market' and other euphemisms for 'capitalism', the idea of an economy co-evolving with nature is foreign to it. Within economics, Marx's insights have suffered a triple marginalisation. First, Marx's contributions were to a grounded theory based on agriculture, whereas agricultural economics today is an ever-more-marginalised sub-field of economics (or is rejected outright and re-incorporated into 'the new institutional economics'). Second, until the publication of the Stern Review economics had sectoralized and neglected environmentally-informed theory. And third, environmental economics has systematically marginalised Marxian ecological economics, just as

neoclassical economics has ignored Marxist economics – along with other heterodox schools which are incapable of being hegemonised.

Attempts have been made to trace two intellectual lines of descent for Marx's legacy on the environment: first through the 'Russian path' involving Kautsky's *'Agrarian Question'* (1899) and Lenin's *'The Agrarian Question and the 'Critics of Marx''* (1901). Both analysed the physical balances between town and country, and Lenin stressed the practical need to conserve the natural environment. It also appears in the use of Marx by early Soviet ecologists and in Bukharin's discussion in the 1920s of metabolic flows and technology in relation to agriculture, in his *'Historical Materialism'*. Under Stalin's purges of ideas as well as the people who advanced them the conservation of nature was considered 'bourgeois' and concern with it stopped. Bukharin was put paid to. The Soviet disconnection from ecology and its era of 'ecocide' cast a long shadow over Marxist environmentalism in the West where Marxism also fell victim to the rift between natural and social sciences.

The second line of descent is a continuous thread running through the early history of British socialist thought and practice, particularly of the Fabians in their interaction with science in general, and with ecological science in particular. In the 1930s Arthur Tansley developed the modern concept of the ecosystem which applied to the interaction between organisms and their habitats at all scales. He included human beings as exceptionally powerful biotic factors. Both genealogies culminated in a new recognition of Marx's legacy, accompanied by what Martinez-Alier has described as 'surprise if not repudiation', when environmentalism finally entered politics in the 1970s, and it is only recently that a Marxian ecological economics has started to be developed.

SOME CONTROVERSIES AND DEBATES

Because of its somewhat fragmentary nature and long neglect, Marx's ecological thought has inevitably led to debates about its meaning, adequacy, relevance, etc. One concerns the *significance* of Marx's environmentalism. Having pieced together Marx's environmental thought, Foster (2000) concludes that its neglect by Marxists has been unjustified. For Martinez-Alier and Schlupmann (1990, p. 219-221) by contrast, Marx failed to develop his analysis of nature-economy-society relationships, in particular the metabolism of energy and thus energy accounts. The concepts of simple and expanded reproduction fail to account for the replacement of used-up means of production in an economy based on exhaustible resources and a regenerative capacity which can be exhausted. Having criticised Ricardo effectively, and because of these analytical inadequacies, Marx's further discussion of natural resources is not through class and inter-generational physical allocations and their waste, instead it is carried out in terms of the implications of rent for the distribution of income, savings and investment and so is more Ricardian and 'metaphysical' than ecological.

Ecology: A second debate concerns the concept of 'ecology' itself. The concept was in circulation and known to Marx before he wrote *Capital*. It means the interaction between society, the economy and natural conditions and so might well have been used and

developed by him, but was not. Foster suggests that Marx, an ardent supporter of Darwin's theory of evolution but an equally ardent opponent of *social-Darwinism*, may have been deterred by the fact that Darwin's leading German follower Ernst Haeckel, who coined the term ecology, was a social-Darwinist, Foster (1999, p. 389, footnote 7). Whatever the reason, Marx cannot be seen as the father of either ecology or ecological economics.

Value: The relations of humankind to nature involve many different aspects that are necessarily abstracted from Marx's value theory which is based on the labour-time of production. Value theory does not preclude the consideration of the impact of accumulation on the natural world. It might even be considered to be an essential starting point in addressing the relationship between capitalism and the environment. But despite the increasing urgency of the issues, the richness of Marx's own account of nature has too often been overlooked by subsequent Marxist value analyses. Nor is the reduction of the environment to the concept of 'externalities' acceptable - as it is to mainstream economics. Ideas such as the sacredness and dignity of nature and human activity also need to be incorporated, and these generate severe problems of incommensurability of values. In ecological economics, but rarely anywhere else, a plurality of incommensurable values has been incorporated. So too is an understanding of the relationship between - and impact of - the meaning and significance of incommensurable values and the material world.

DEVELOPMENTS OF MARX'S THEORY

The 'second contradiction': Contradictions are generated by social relations that are indispensable yet are in opposition, the principal one in Marx being between capital and labour. But from the treatments of nature, labour and social metabolism reviewed above it is clear that capitalist production is not just the production of commodities by means of commodities, but requires production conditions that are not produced by commodities at all. James O'Connor has identified three kinds of such conditions. First, nature, before it enters the regulated process of capital, is not itself produced by commodities. Second, the health and capabilities of labour are produced and reproduced outside the circuits of capitalist production (mainly by women). Third, the 'communal general conditions of social production' (communications and other infrastructure) are mainly produced by collective/social action and the state. Through competition and extended commodification, capitalism tends to degrade all three of these non-commodifiable conditions and society resists the exacerbation of the metabolic rift through social movements that O'Connor (1996) argues cannot be subsumed under the first contradiction.

A third contradiction results from the pressure imposed on nature by the need under capitalism not only to produce but also to consume. Costas Panayotakis argues that the two are in contradiction both with each other and with nature. The distributive share (the wage-profit relation) derived from production affects the level of social consumption. But in the competition within capitalist production for returns to increased labour productivity, free time for the consumption of commodities (or for non-consumption and

leisure) is a gain to labour. Free time, however, is construed by capital through advertising and planned obsolescence as the search for satisfaction by means of the continual consumption of commodities. Not only does this search fail to create satisfaction, time spent searching and consuming attacks the very notion of free time as social space in which workers can create meaning and could pursue activity other than that which deepens the metabolic rift.

CONTEMPORARY MARXIAN ECOLOGICAL ECONOMICS

Marxist ecological economics examines interactions between environment and political economy as processes of 'natural history'. Paul Burkett (2006) describes this project, developed since the 1990s, as multidisciplinary, theoretically and methodologically pluralist, and receptively oriented to practical politics. The specifically Marxist contribution to it develops the analysis of the materiality and energetics of class relations expressed in economic activity and the creation of exchange value through the appropriation of natural resources. The method, though still in its infancy, is being applied fruitfully at both ends of the town-country rift: to cities - examining the ecological distortions of metabolic stocks and flows (e.g. water, biomass, metals, fuels, minerals) and to agrarian social relations and soils - exposing a variety of rifts in nutrient cycles (failures to recycle waste, replacement of organic manure by chemical fertiliser, replacement of animal energy and manure by machines and fossil fuel).

Distributional conflicts Ecological struggles can take many forms: between capital and labour, or competitive struggles between individual capitals or sectors of the economy, between the state (with or without the complicity of capital) and labour or the state against subsistent peoples, or capital against common property resources, or against NGOs. People also struggle for subsistence and 'sustainability itself' in the face of the deterioration of the environment's capacity to recycle and regenerate sustainably. While all aspects of the process of resource extraction, production, circulation, consumption, social reproduction, waste and natural regeneration are contested, struggles over the control and appropriation of nature's 'taps' (e.g. farmland, water, oil and other fossil fuels, metals) are better known and better researched, though not necessarily more important, than those over 'sinks' (e.g. waste disposal sites, forest, the atmosphere). Martinez-Alier (2007, pp. 286-8).

Marxist eco-feminist economics is as yet a small field examining the impact of the socially divisive economic effects of distinctions and practices based on gender on the environment. Eco-feminist thought develops the concept of the gendered division of labour, studying the ways in which women have a grounded relationship with nature through their socio-biological reproductive activity, compared with the alienated relationship with nature in which men are placed through their distinctive contribution to (environmentally destructive) production. Marxist eco-feminist economists critique the concepts of value involved in the capitalist destruction of nature and develop a class analysis of the material relations of patriarchy expressed in the economy, e.g. Johnson (1999, pp221-9)

Materials Flow Analysis: Marx left it to others to develop quantitative accounts of stocks and flows of energy, minerals, and biomass: the task was first taken up in 1920s work on socialisation by the political economist Otto Neurath, who was influenced by Marx. The incommensurable values in which energy and materials have to be accounted have been systematized in accounts for the domestic extraction, imports/exports and naturally decomposed and market-recycled wastes of minerals, fossil fuels and biomass. These physical accounts generate measures of net accumulation which differ from those of conventional national accounts statistics. Attempts have been made to make environmental loads measurable and thus comparable through weight or energy equivalents. Initial results show unequal materials and energy exchanges between developing and advanced capitalist economies: the CO₂ produced and the energy and materials embodied in exports vastly exceed those of imports. But while such physical accounts have been established for many OECD countries they have yet to be systematically developed worldwide. And their analysis in terms of their implications for different social classes is a project for the future, EUROSTAT in Martinez-Alier (2007, p. 280; pp. 290-1, footnote 20, and p. 292 footnote 29).

THE ECOLOGICAL QUESTION: CAN CAPITALISM SURVIVE?

The capitalist commercialisation of the earth's resources and sinks (land and forests, oceans, the air), and the environmental depredations of Soviet and Chinese industrialisation and 'heavy agriculture', have damaged biodiversity, natural recycling processes and ecological resilience to the point where there is now a crisis threatening the existence of not only global capitalism but human society itself. The ecological question is the biggest of our time, and perhaps of all human time. Will capitalism survive and prevail at whatever cost to humanity? Underpinning the view that it will, the logic of capitalism depends on the production relations of commodified labour, not on fossil fuels. Resource scarcities increase prices, which induce technical change and new physical and social arrangements; so does capitalist competition in its search to reduce the costs of labour. Since capitalism requires non-commodified conditions to reproduce, it will continually de-commodify and re-commodify the private and public spheres as it de-materialises. The resulting planet may be unattractive and may not even support human life on today's scale, but capitalism will be humans' final mode of production on earth.

Certainly a 'new' or 'green capitalism' is being created and promoted by Al Gore and others. Taking the logic and economic inequalities of capitalism as unchallengable, this view envisages a combination of energy- and materials-efficient technologies (including nuclear energy, biofuels, genetically modified organisms and geo-engineering together with a politically-directed commodification of carbon emissions Carbon Cap and Trade schemes and the Clean Development Mechanism). Along with some eco-socialists and green parties but for different reasons, some capitalists call on the state to secure the efficient use of energy and develop renewable energy, since market forces are doing neither sufficiently fast, Altvater (1993).

But such proponents of a 'new capitalism' neglect capital's logic of expanded reproduction and the historical relations between materials, energy and labour under capital – the metabolic rift. The range of untried, risky and even as yet impracticable measures envisaged by the 'new or 'green' capital' school ignores the principle of precaution which should govern any rational social response to the known risks and unknown uncertainties involved.. Altvater (1993), by contrast, does not think capitalism can survive. Among his several lines of argument two stand out as relevant here. First, capitalist (and communist) industrialisation was only possible using energy from fossil fuel (FF), which is why it is such a prime object of competitive military security worldwide. The high 'energy density' of fossil fuel has allowed the development of physical and social infrastructure (pipelines, tankers, motorways) whose working life stretches 40-50 years into the future. It is incompatible with the lower density of renewable energy (wind farms, solar-photovoltaic energy). Second, the domination of finance capital over manufacturing capital requires material growth to generate returns exceeding the interest on loans. To date, the logic of accumulation and the necessity of growth have overwhelmed gains in materials and energy efficiency per unit of output. A 'new capitalism' would have to be of a kind that nothing presently indicates is capable of emerging from capitalism as we now know it, Panitch and Leys (eds) (2007) see also Sarkar (1999).

The 'dematerialisation' of capitalism which appears necessary for the globe to survive under its continued hegemony also faces massive obstacles in the shape of the undemocratic politics through which the process of capitalist commodification itself proceeds. It is clear that nothing less than a global mobilisation of labour/ 'mankind', demanding its dematerialisation, is needed to initiate and legitimate the process and finally, in order to govern its metabolism sustainably in the interests of human development for all, to transcend capitalism itself.

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